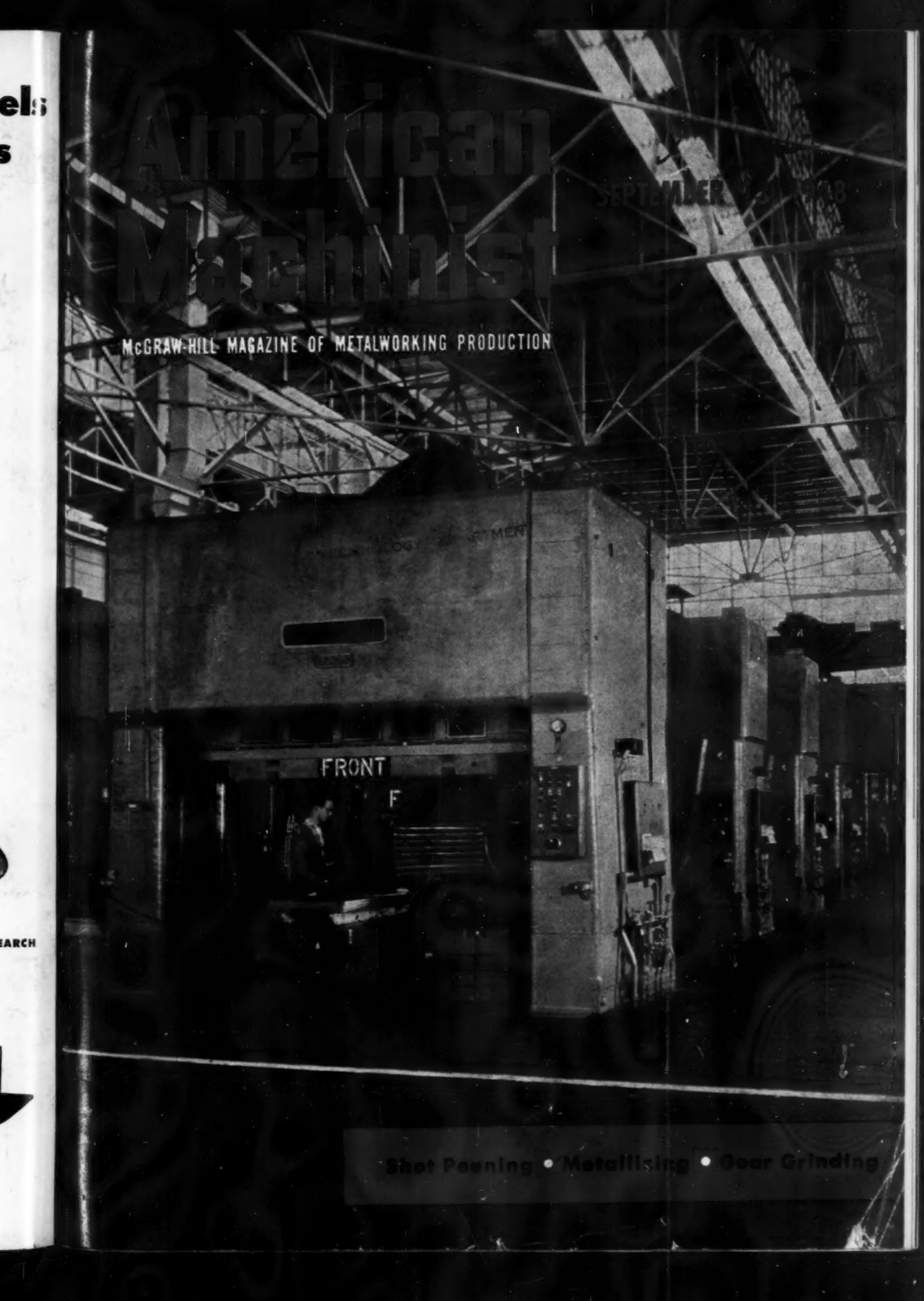
American Machinist
SEPTEMBER
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION
FRONT
Shot Peening • Metallising • Gear Grinding

PRODUCTION INCREASED 110%

5 HOLES BORED
with exact spacing in a single setup.

Four holes in this washing machine gear case are bored, faced, and chamfered by a four-spindle cluster head on the Model 222 Bore-Matic, holding close accuracy for spacing and alignment. The fifth hole is finished by the right head.

and costs cut 63¢ on the dollar

...with a

NEW Heald Bore-Matic

That's the actual production record of a leading washing machine manufacturer. When a new Heald Model 222 Bore-Matic took over the job of finishing gear cases, production went *up* 170 per cent—and costs came *down* 63 per cent!

Five holes are precision bored, faced and chamfered in a single setting, obtaining close accuracy for spacing and eliminating several operations and setups previously required.

Easy, convenient operation, combined with a fast hydraulic fixture and rapid cycle, enable an operator to run this Bore-Matic and also a drill used for a previous operation.

Perhaps you don't have a job exactly like this one—but you *do* have the same opportunity to reduce costs, increase production and improve quality with the new Heald Bore-Matics. For further information on these outstanding new machines, we invite you to contact your nearest Heald representative or Worcester direct.

Heald
Model 222
Bore-Matic

NEW BORE-MATIC FEATURES CAN HELP DO A BETTER JOB ON YOUR WORK, TOO

The cost-saving installation shown here is not an isolated case—it's typical of what the new Bore-Matics can do for *every* manufacturer. This is made possible by new features such as—faster table traverse, higher speeds, constant feeds, low temperature hydraulic system, cool running heads, perfected way lubrication, leak proof piping, and many more. These features can help you do a *better* job, *faster*, and at *less cost*. They're worth investigating.

HEALD

THE HEALD MACHINE COMPANY, Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • New York

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TECHNOLOGY DEPARTMENT

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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Member of the Associated Business Papers and the Audit Bureau of Circulations.

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Published every other Thursday. Price 35c per copy. Allow ten days for change of address. Subscription Rates: United States and possessions, $5 a year, $8 for two years, $10 for three years. Canada, $6 for one year, $10 for two years, $12 for three years. Pan-American countries, $10 for one year, $16 for two years, $20 for three years. All other countries, $20 a year, $30 for two years, $40 for three years. Please indicate position and company connection on all subscription orders. Entered as second-class matter, August 13, 1943, at Post Office, New York, N. Y., under the act of March 3, 1879. Printed in U.S.A. Return postage guaranteed.

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PUBLISHED BY McGRAW-HILL PUBLISHING COMPANY, INC.
330 West 42nd St., New York 18, N.Y. Cables: "McGRAW-HILL, NewYork"

James H. McGraw (1860-1948), Founder; James H. McGraw, Jr., President; Curtis W. McGraw, Vice-President and Treasurer; Eugene Duffield, Executive Assistant for Publications; Nelson Bond, Director of Advertising; Joseph A. Gerardi, Secretary; J. E. Blackburn, Jr., Director of Circulation

Chips and QUIPS

Our Cover . . . The imposing line of 9 Hamilton presses in our cover Kodachrome were recently installed in an automotive plant. Heading the line is a 3-slide toggle-action unit with all drive gearing, toggle-action drive and lower-slide adjustment elements below the floor line. The press is 108 in. wide and 64 in. deep, and is a tension-design unit, requiring no arch or tie rods. Direct motor drive eliminates the conventional clutch. Some such units have been 200 in. wide and 100 in. deep.

The other eight presses are 4-point, single-action units equipped with self-aligning pressure cylinders, and with all drive gearing, eccentrics and eccentric connections mounted in and traveling with the slide. Slide adjustment is at the bottom of the bed. Tension construction eliminates arch and tie rods, so uprights act only as slide guides. Clutches are eliminated by direct motor drive. Such units have been made to 200-in. width and 101-in. depth; these are 84 in. wide and 50 in. deep.

See the "robot press" story, too.

Reproduction . . . Paper, as you may have heard, has been hard to get. We've had to use paper stock in some issues that was not topnotch, and when our paper mill developed a new and better printing surface, things kept going wrong to slow up deliveries. But we're now out of the woods, for one reader actually spotted a *home-made* hand knob in a recent illustration—and wrote a letter to the author to suggest that better knobs could be purchased for less. The knob in question, as pictured, was *less* than ¼ in. in diameter, and in a big illustration, so the printing—and paper—must be pretty good.

Metallizing . . . Sprayed metal coatings are now familar to most shop men, but some of their characteristics still baffle the unwary. They're pervious (which makes them excellent bearing materials) unless some after-treatment is provided, and bonding is a danger spot. So John E. Wakefield of Metallizing Engineering Company has set down some of the causes of failures and how to avoid them.

Bimetal Heat-Treat . . . W. M. Chace Co., Detroit, makes bimetal thermostat strip. When this is process-annealed, between rolling operations, it curls—as bimetallic strip is supposed to do. To avoid this difficulty, Sunbeam designed a double-chain conveyor furnace, so the strip is held between chains. Quite a trick—described herewith.

Tooling . . . For tool engineers, we provide in this issue a series of short articles. One, from the Naval Gun Factory, describes how to align a long straightedge. Another shows low-cost fixtures made from vises. A third explains some tricky welding fixtures, a fourth outlines recent special tooling, a fifth shows cooling forms for plastics.

Peening . . . Shot peening, particularly of selected areas, can do much to increase surface hardness and fatigue life of parts. Curtiss-Wright has been doing a lot of this recently, so we asked J. Epprecht and H. W. Eberhardt to tell about it. They do—in our lead article.

Better Etch . . . Discussing our report on painting aluminum, C. R. Gentry, mechanical engineer of the Va. Dept. of Correction, points out that, contrary to general instructions, a caustic etch had better precede the painting of aluminum. Says he: "Two years and some three million license tags later, we know that etched tags retain paint nicely, while unetched aluminum requires repainting in a matter of weeks."

Coming . . . Oct. 9 *A.M.* has a number of features. The cover is probably the best forging Kodachrome we've seen. The special report deals with shop safety. Our lead shows why an older shop man should be married, based on a Lockheed survey that rivals Kinsey. There are several tooling features: on planer tools, on dieheads for turning, on making Buick Dynaflow brake bands, on machining odd-shape parts.

GEAR GRINDER . . . Leo P. Tarasov was graduated in 1933 with a B.S. in physics from Case Institute and received his Sc.D. in applied physics from MIT four years later. He worked on ferromagnetic problems at the GE Research Lab. for three years, and as a metallurgist for Beryllium Corp. for one. Since 1941 he has been a metallurgical engineer in the Norton Company Research Lab., working primarily with the quality of ground surfaces and the metallurgical and physical aspects of grinding. Several of his articles on injury to ground surfaces, surface finish and Knoop hardness testing have been published. He is a member of the ASM, AIMME, ASTE, and American Physical Society. A registered professional engineer, he is currently chairman of the Worcester chapter, ASM. The second half of his 2-part article on gear grinding is in this issue.

TECHNOLOGY DEPARTMENT

Why Test Bevel Gears?

★ Testing simulates actual operating conditions, gears are rigidly mounted, run together in pairs under power and with a light load. Thus a check can be made for size, runout, smoothness and quietness of operation and tooth boring.

TEST GEARS

On the New Gleason No. 17-A Hypoid Tester

1. Before Production

In establishing the correct set-up for the gear generator, testing shows what readjustments of machine settings are needed.

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Uniform quality of cut gears can be kept constant if checking is done during production.

3. Final Test

This determines the correct set-up for the bevel gears in final assembly. It eliminates the unnecessary tearing down and costly refitting.

The No. 17-A Hypoid Tester is designed with a dial adjustment which once set up, automatically duplicates backlash on each pair of gears. Correct mounting is read simply and easily from an indicator and the best running position of the gears in final assembly is thus easily obtained.

GLEASON Works
1000 University Avenue
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Builders of Bevel Gear Machinery for Over Eighty Years

FLOOR PLATES GET THEIR ANTI-SKID TREAD on a CINCINNATI Hydro-Tel Milling Machine

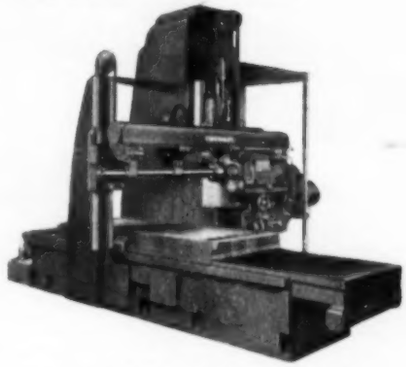
CINCINNATI No. 36-120 Horizontal Hydro-Tel Milling Machine, tooled up to mill straight or helical grooves in floor plate rolls. Straight grooves have been milled in this roll, the body of which is 77" long.

Inset: Close-up of indexing and driving mechanism for milling straight or helical grooves in floor plate rolls.

A prominent steel manufacturer mills the anti-skid tread in their floor plate rolls on a CINCINNATI 36" Horizontal Hydro-Tel. The machine accommodates several sizes of rolls, and mills two types of tread — straight or helical grooves. Of course, Cincinnati Application Engineers had a hand in this job. They equipped the machine with an index fixture which incorporates roll journal rests, and a rack attached to the bed for rotating the roll to mill the helical grooves.

A sintered carbide formed cutter is employed, cutting at a feed rate of 14" per minute. The rolls are chilled iron.

CINCINNATI 36" Horizontal Hydro-Tel Milling Machines have the capacity and range for milling large heavy work. And they have many labor-aiding and cost-reducing features. You may learn more about them by writing for catalog M-1629.



CINCINNATI 36" Series Horizontal Hydro-Tel Milling Machine. Catalog No. M-1629.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

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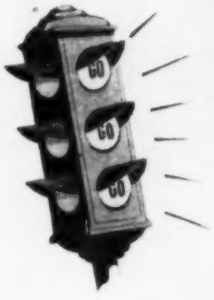
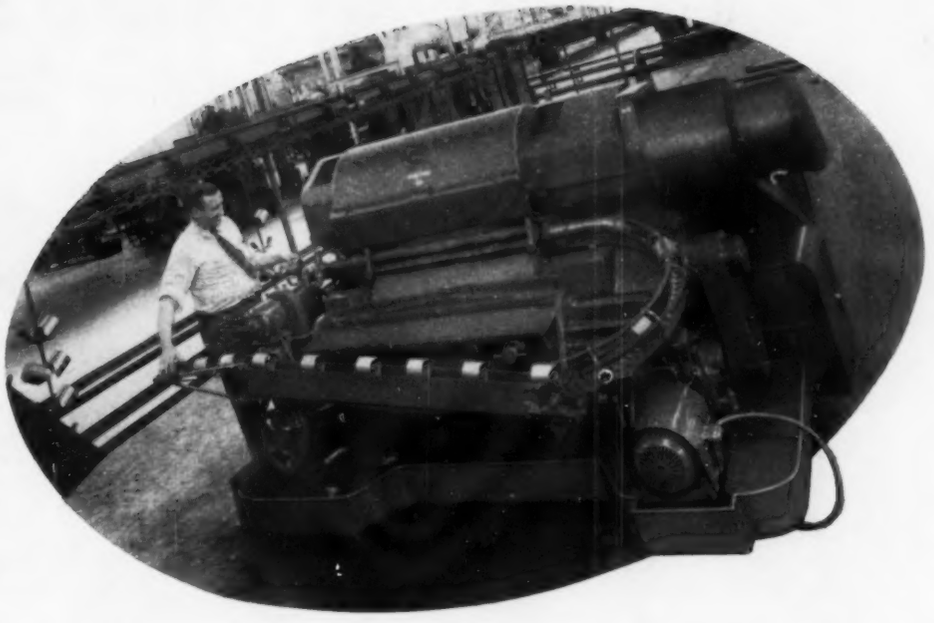




. . . on this HIGHWAY to PRODUCTION

CINCINNATI

Cincinnati Grinders Incorporated offers you the right size of FILMATIC Centerless for your job. They are built in six sizes: Nos. 0, 2, 3, 4, 5 and 6. The No. 5 size is illustrated here. Specifications available on request.

● Stop and go plays hob with production. Whenever it can be avoided, you can be sure that costs will tumble. How this was accomplished in a piston manufacturing line is illustrated at the top. The machine is a CINCINNATI FILMATIC No. 5 Centerless Grinder, equipped with a miniature highway to production . . . a horseshoe conveyor line which returns the pistons to the operator at his working position. With his left hand, he starts the pistons on the initial leg of their journey between the wheels; with his right hand, he returns them to the conveyor line. What could be more simple in reducing the cost of precision grinding? ¶ CINCINNATI FILMATIC No. 5 Centerless Grinders offer much in any shop where large parts are ground, or where it is necessary to grind away an unusually heavy stock allowance. They have a capacity of 1" to 7" diameter work; thrufeed or infeed; up to 36" width of wheel; up to 50 hp grinding wheel motor; may be operated as isolated equipment or as part of a production line. And like other CINCINNATI Centerless Grinders, the No. 5 offers all the advantages of FILMATIC grinding wheel spindle bearings . . . self-adjusting; they run for years without maintenance; they keep things moving on the highway to production. Additional data on the No. 5 FILMATIC Centerless may be obtained by writing for specifications.

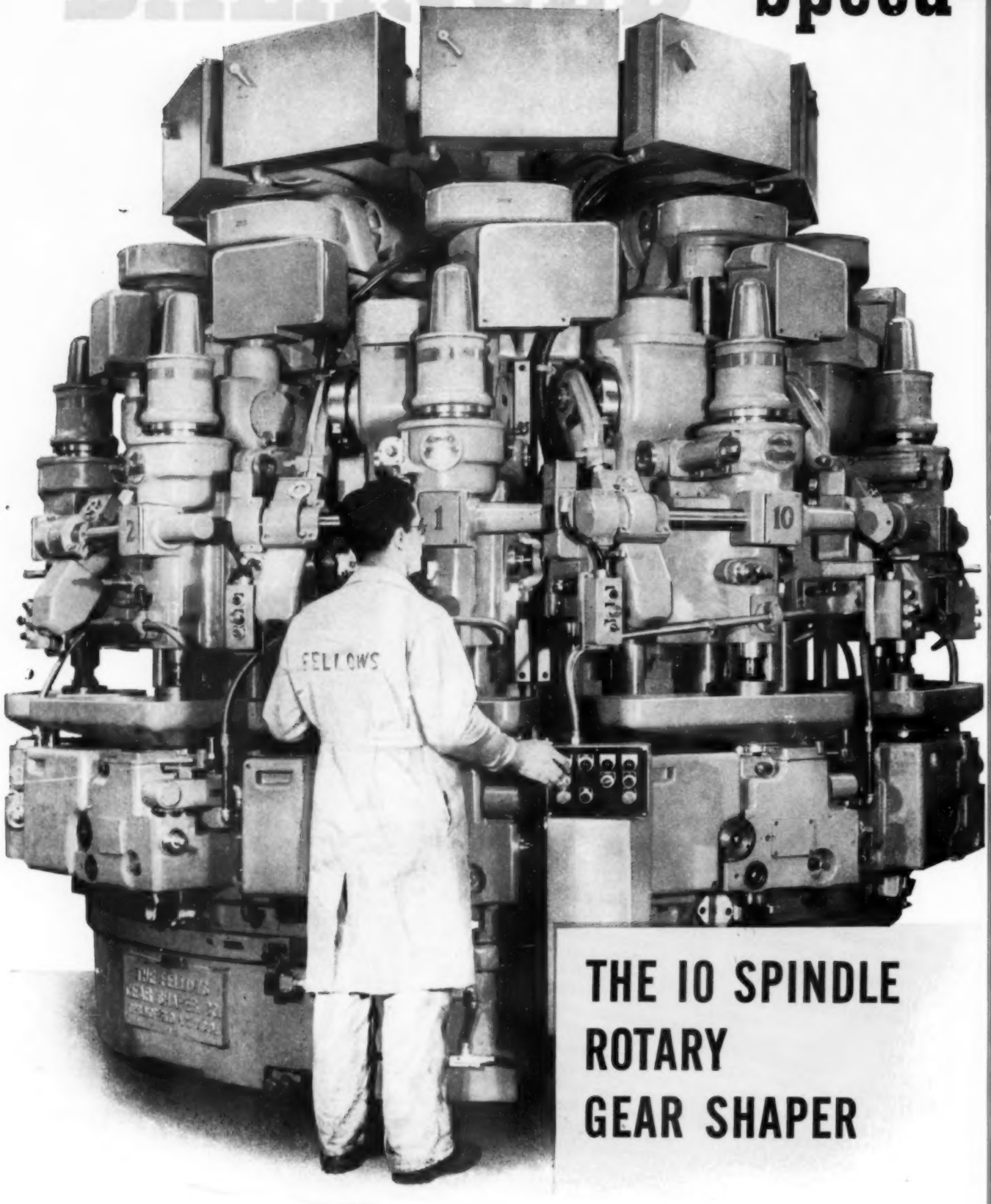
CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES

BALANCED

Speed-



THE 10 SPINDLE ROTARY GEAR SHAPER

GEAR SHAPERS • THREAD GENERATORS • CUTTERS • SHAVING AND BURNISHING MACHINES

ed-Production of Mating Gears

301 PER HOUR ON 6 STATIONS
3 pieces per load
Steel, 51 teeth, 24 pitch, 14½° P.A., 20°2'51"
L.H. helix, .090" tooth depth, .438" face width.

...plus

301 PER HOUR ON 4 STATIONS
3 pieces per load
Steel, 39 teeth, 24 pitch, 14½° P.A., 20°2'51"
R.H. helix, .090" tooth depth, .438" face width.

Combined

ON ONE BIG MACHINE

This dividing of the 10-stations of the Rotary Gear Shaper between two gears is only one possibility.... All 10 stations might be put on one job—or divided among 3, 4 or more different gears. Both external and internal gears are handled, any blank diameter to 12 inches.... The point we emphasize is that each station is an independent production unit, with independent time-cycle and automatic start and stop controls. Each No. 10 Rotary Gear Shaper can be a complete gear department. The space economy, high production rates and ease of attendance are revolutionary advantages. Write or call on the nearest Fellows office.

Fellows

THE FELLOWS GEAR SHAPER COMPANY
Head Office and Export Dept., Springfield, Vermont. Branch Offices: 616 Fisher Bldg., Detroit 2. 640 West Town Office Bldg., Chicago 12. 7706 Empire State Bldg., New York 1.

NES

GEAR MEASURING AND INSPECTION INSTRUMENTS • PLASTICS MOLDING MACHINES

What kind of heading wire

AMERICAN STEEL & WIRE COMPANY
USS AMERICAN
MANUFACTURERS WIRE
UNITED STATES STEEL

NEED carbon . . . stainless . . . alloy heading wire? Wire for socket bolts? Nuts? Screws? Recessed-head screws? We make wire for them all. In fact we have been known as "Wire Headquarters" for the heading industry for many years. In that capacity, we have developed many types of wire which have contributed enormously to the progress of the heading industry. For example, many heading jobs that were formerly done hot can now be done cold—largely because we have helped to develop the right kind of wire.

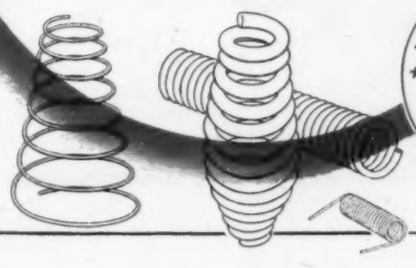
But heading wire is only one of thousands of different types of wire we produce. Our U·S·S American Quality Wire has proved its merit in thousands of different manufacturing uses. Our unexcelled research and modern production facilities plus over a century of quality wire-manufacturing experience make it possible for us to draw wire for any application. At present the demand for our high quality wire products far exceeds the supply, but we are making every effort to satisfy our customers' requirements.

For further information on any of our products please call or write our nearest office, or 424 Rockefeller Building, Cleveland 13, Ohio.

do YOU need?

WHAT KIND OF SPRINGS DO YOU NEED?

Whether you use simple springs to flip women's compacts open gently or hot wound springs to cushion the surge of powerful locomotives, we can supply you. For we produce springs from round wire, shaped wire, flat wire or strip steel, from either pretempered, or formed-and-then-tempered, material. And whether your springs must perform under severe fluctuating stresses . . . in serious corrosive conditions or other unusual operating conditions, you can count on top performance. For the springs we produce are accurately tested to make certain that they will fit the application.



AMERICAN STEEL & WIRE COMPANY
USS
AMERICAN SPRINGS
UNITED STATES STEEL

WHAT KIND OF COLD ROLLED STRIP DO YOU NEED?

U·S·S American Cold Rolled Strip is produced in a wide range of analyses and tempers in carbon, stainless and alloy steel and with any standard edge you might need, in the established widths for the different edges. The three types of strip are produced in all commercial bright finishes. In addition, the carbon strip is furnished in either galvanized, tinned, coppered or special finish. Our low carbon strip is made in sizes from 23 15/16" down to ½" wide in hard, half hard, quarter hard, soft skin-rolled and dead soft tempers. Tempered steels are made up to 7" wide in four different finishes; black, scaleless, polished, and polished and colored. While the demand for our strip steel far exceeds the supply, we are making every effort to satisfy our customers' needs with the best steel available.

AMERICAN STEEL & WIRE COMPANY
USS
AMERSTRIP
COLD ROLLED STRIP
UNITED STATES STEEL

AMERICAN STEEL & WIRE COMPANY Cleveland, Chicago and New York

COLUMBIA STEEL COMPANY San Francisco

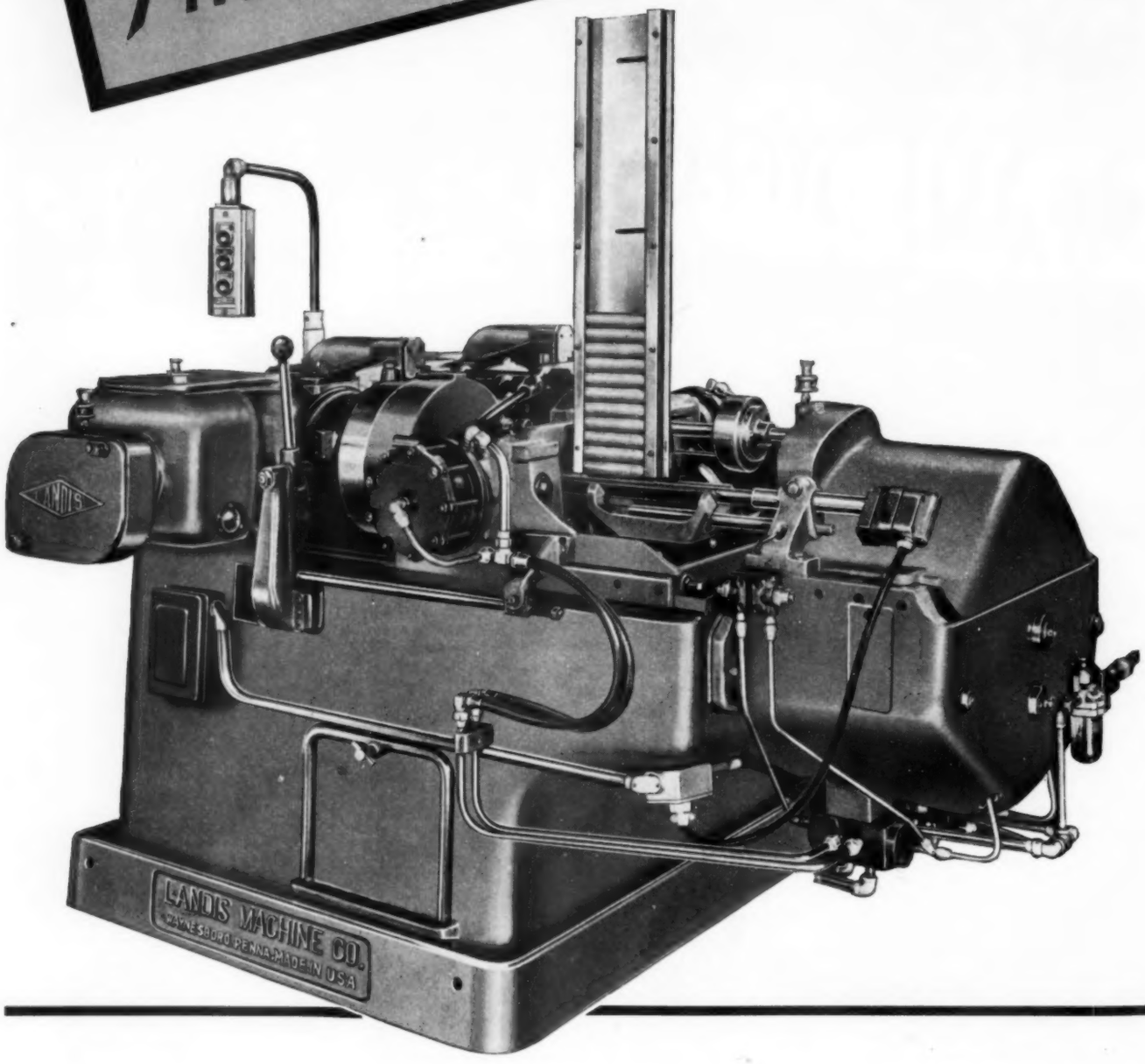
Tennessee Coal, Iron & Railroad Company, Birmingham, Southern Distributors — United States Steel Export Company, New York

UNITED STATES STEEL

LANDIS Announces

THE Improved

THREADS, ON



THE WORLD'S LARGEST EXCLUSIVE MANUFACTURERS

AUTOMATIC NIPPLE MACHINE

REAMS, & CHAMFERS NIPPLES BOTH ENDS AUTOMATICALLY

THE new LANDIS Automatic Pipe and Nipple Threading Machine threads, reams, and chamfers nipples in a continuous automatic operation, thus eliminating secondary manual handling. Through a transfer mechanism, this operation can be automatically performed on *both* ends of the nipples. Among the outstanding features of the improved machine are: A one-piece bed which gives the machine greater rigidity, and a new transfer mechanism that reduces breakdowns and allows longer continuous production.

AUTOMATIC OPERATION

Two nipples are completely machined on one end during the operation cycle. A magazine feeds nipple blanks into the left-hand carriage. These blanks are fed into the die head at a rate equal to the lead of the thread being cut. The semi-finished nipple is transferred end-to-end to the right-hand carriage by mechanical fingers for the operation on the opposite end. At the same time a second nipple is being fed into the left-hand carriage from the magazine. Thus opposite ends of two nipples are machined simultaneously. Nipples are automatically ejected when finished.

CONSTRUCTION FEATURES

The improved LANDIS Automatic Nipple Machine has many other features which contribute to efficient and economical operation. The bed is provided with new type rectangular hardened steel ways. This improves maintenance and alignment of the carriage, and gives longer life to the carriage and bed. Sheet steel chip guards cover the ways in front of the carriage. A constant speed motor with pick-off gearbox allows varied spindle speeds for different pipe sizes. Serious damage by jams is prevented by built-in safety devices. Lubricating devices for all bearings have been placed for easy accessibility.

SPECIFICATIONS

The improved LANDIS Automatic Nipple Machine is built in two size ranges. One includes nipples from ½″ to ¾″ pipe size and lengths from 2″ to 6″; the other will handle 1″ to 2″ pipe sizes with a maximum nipple length of 6″. Production ranges from 200 to 625 per hour, depending on the pipe size. Write for Bulletin D-84.

LANDIS Machine COMPANY
WAYNESBORO, PENNA.

LANDIS TRADE MARK REG. U.S. PAT. OFF.

OF THREADING EQUIPMENT

LANDIS TOOL universal grinders

for these precision grinding jobs

straight cylindrical
shoulder
taper
face
internal

12" x 28" Universal & Tool

12" x 36" Type LCH Hydraulic Universal equipped with internal grinding fixture

(Internal fixture raised for external grinding)

(Internal fixture lowered for internal grinding)

	Variable Speed Headstock Drive	Microsphere Spindle Bearings	Hand and Automatic Wheel Feed	Hydraulic Table Traverse	Two Speed Hand Traverse
*12" x 28" Universal & Tool	✓				✓
10" x 20" Type H Hydraulic Universal	✓	✓	✓	✓	✓
10" x 24" Type CH Hydraulic Universal	✓	✓	✓	✓	✓
12" Type LCH Hydraulic Universal	✓	✓	✓	✓	✓
14"—18" Type C Hydraulic Universal	✓	✓	✓	✓	

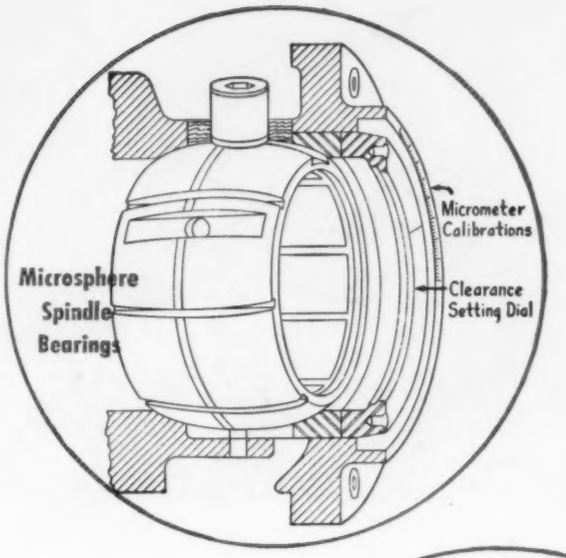
*The 12" x 28" Universal and Tool is equipped with precision anti-friction spindle bearings, adjustable mechanical table traverse and coarse and fine feed for the grinding wheel.

10" x 20" Type H Hydraulic Universal

10" x 24" Type CH Hydraulic Universal

LANDIS TOOL *Precision Grinders*

Variable Speed Headstock



outstanding design features

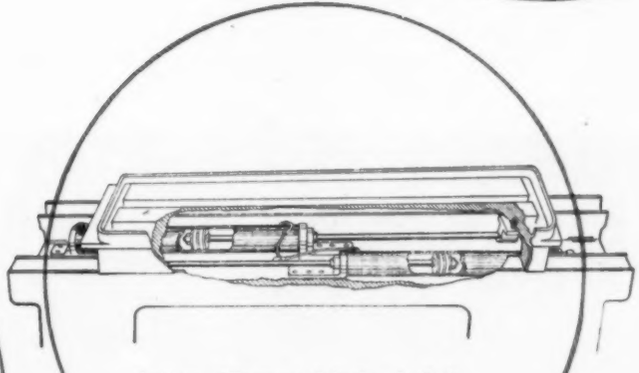
rapid set-up

high production

fine finishes

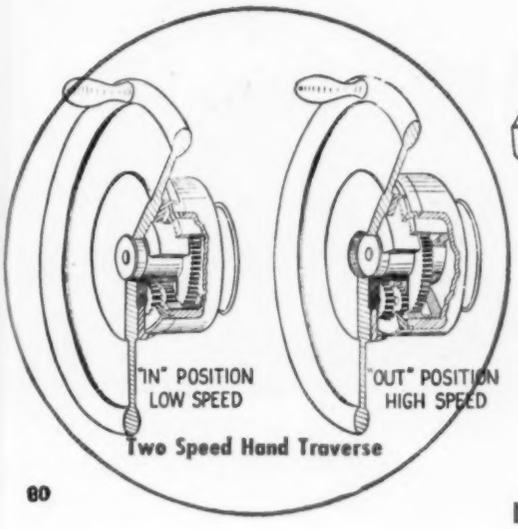
close tolerances

Hand and Automatic Wheel Feed



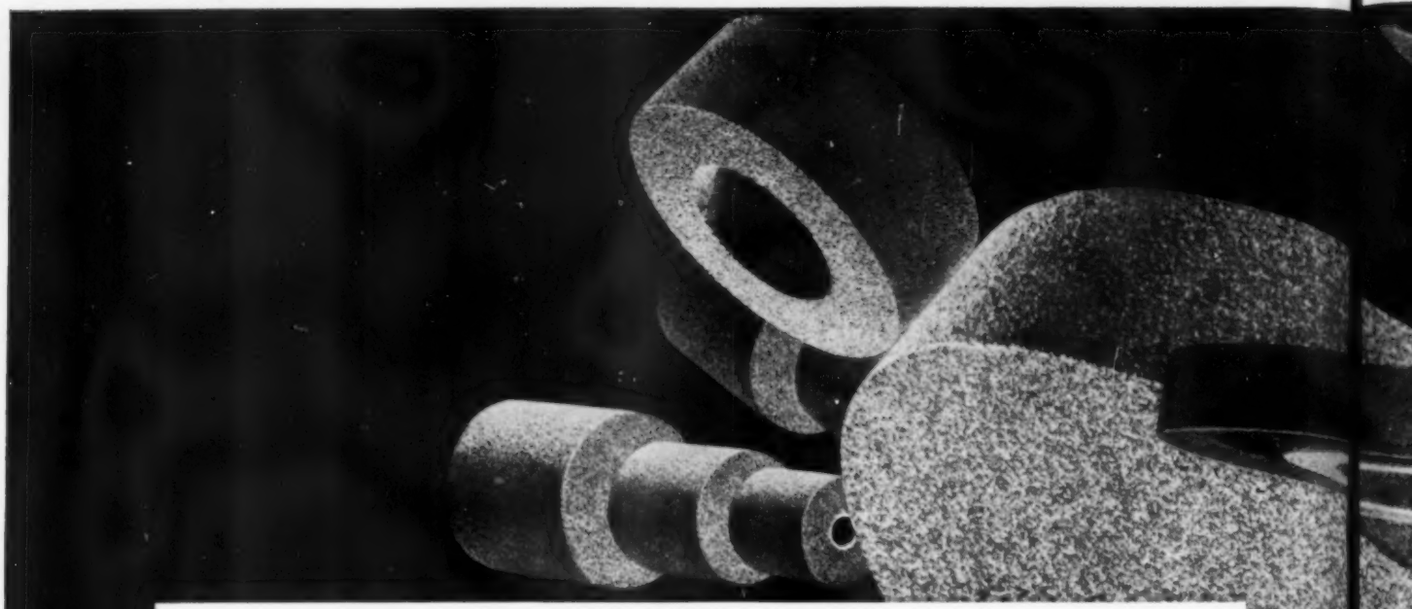
Position of Traverse Cylinders in Bed

Hydraulic Table Traverse



Two Speed Hand Traverse

LANDIS TOOL COMPANY, 10 E. SIXTH ST., WAYNESBORO, PENNA.



How to stop run-away grinding costs

In this period of rising costs, wouldn't you like to stop your run-away grinding costs dead in their tracks?

Here's the surest way to do it: put your emphasis on really *efficient operation*, not on low initial costs. For cheap grinding wheels, with low wheel-life and stock-removal and high dressing costs, never pay off in the long run.

It's by increasing the efficiency of your grinding that Peninsular can lower your costs. For Peninsular furnishes you with wheels individually engineered for every job. A thorough examination and analysis of all your grinding problems comes *before* any Peninsular recommendations.

Because of this exhaustive examination, made right at your plant by Peninsular engineers, you can be sure that the wheels you get from Peninsular are the most efficient for your conditions—for your machines, your methods, the materials you grind and the finishes you need.

So don't try to make savings by buying cheaper wheels. Peninsular can make *greater* savings for you by increasing wheel-life and stock-removal and lowering dressing costs—we'll stake our reputation on it!

Call in a Peninsular engineer *soon*.

The Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7. *Sales Offices:* Chicago, Philadelphia, Buffalo, Cleveland, Pittsburgh, Houston, St. Louis, Cincinnati.

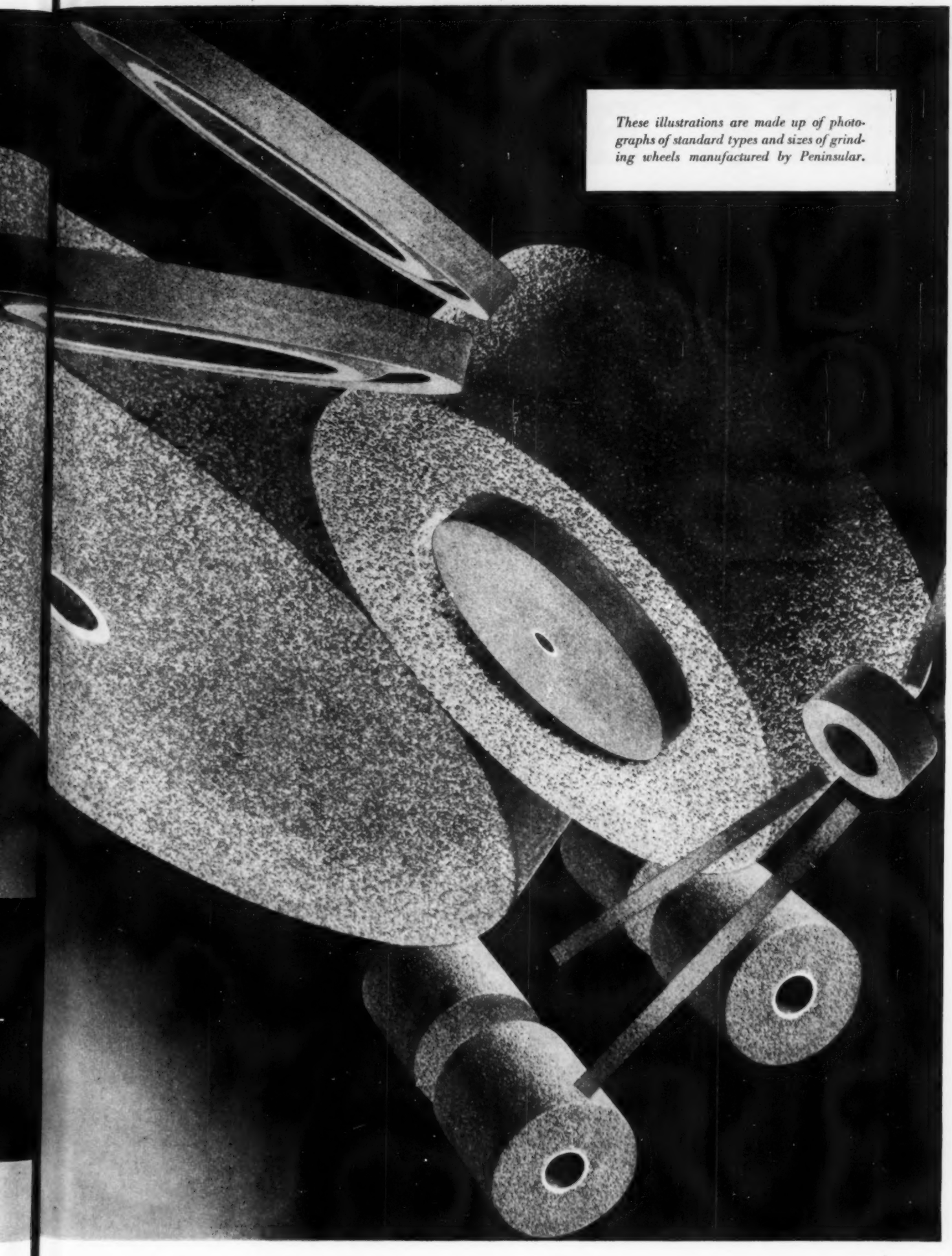
PENINSULAR

INDIVIDUALLY PENINSULAR *ENGINEERED*

GRINDING WHEELS

SINCE 1889

SPECIALISTS IN RESINOID BONDED WHEELS



These illustrations are made up of photographs of standard types and sizes of grinding wheels manufactured by Peninsular.

A STATEMENT OF FACT

LINK-BELT BALL and ROLLER BEARINGS are GOOD BEARINGS

Yes, they've got to be good! They've got to have what it takes to carry the load . . . to handle the tough jobs as well as the easy ones . . . to roll smoothly and dependably under widely-varying operating conditions . . . to perform with complete "service-satisfaction" over a long period of time.

Once these dependable, precision-built bearing units are installed on your equipment, you'll join thousands of other satisfied users in this simple statement of fact — LINK-BELT BALL and ROLLER BEARINGS are GOOD BEARINGS.

LINK-BELT
BALL AND ROLLER
BEARINGS

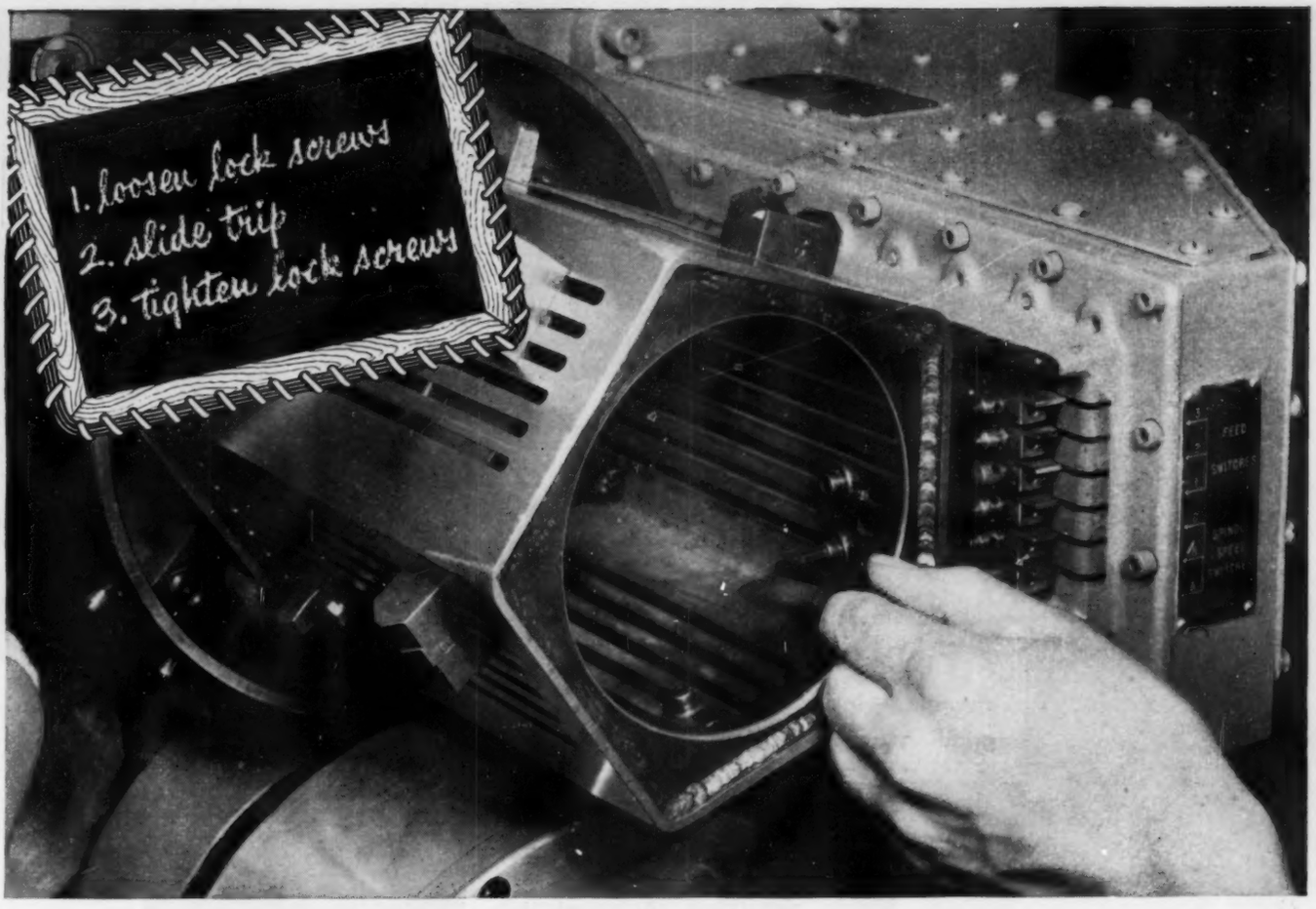
Send for Catalogs!

LINK-BELT COMPANY

519 N. Holmes Ave. • Indianapolis 6, Indiana

STOCKS IN PRINCIPAL TRADING AREAS

11,150



It's as simple as that!

TO set the feed stroke on a Warner & Swasey Single Spindle *Camless* Automatic, just loosen two small socket head screws, slide the trip to the new position, and tighten the screws again. The automatic speed and feed changes, the length of cutting stroke, and skip indexing are all governed by this easy-to-reach control drum. During automatic operation the drum is wholly covered for complete protection.

1-AC Single Spindle Automatic Chucking Machine—6" turning length, 8" or 10" chuck.

Nine big features make this *the* profitable machine for short and long production runs:

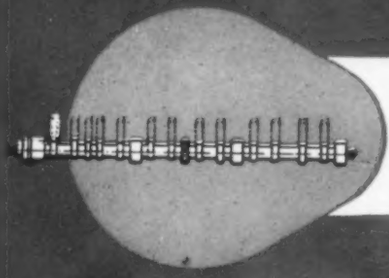
1. Eight ranges of four automatically selected speeds.
2. Any speed, within a selected range, may be set on any turret face and may be changed during the stroke.
3. Any three, out of eighteen feeds from .002" to .083", are automatically available during operation.
4. Either or both cross slides can be selected to operate with any or all turret faces.
5. Turret can be automatically skip-indexed to eliminate unnecessary approach strokes.
6. Alternative hand control of all functions.
7. Reduced number of bearing surfaces and smooth shockless indexing retain original accuracy.
8. Advanced design reduces tool overhang for less chatter, closer tolerances.
9. Adequate chip clearance and capacity . . . Selector valve delivers coolant to operating station only.

It's simpler **to set up a Warner & Swasey CAMLESS Automatic!**

WARNER & SWASEY
Cleveland

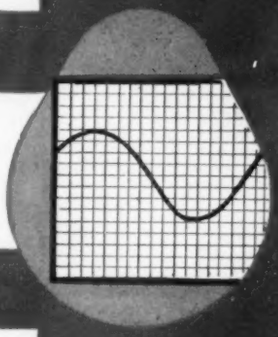
TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

For Grinding Camshafts *at Minimum Costs!*



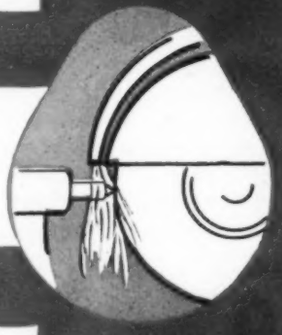
All cams and the eccentric on a shaft ground successively—automatically—in one handling.

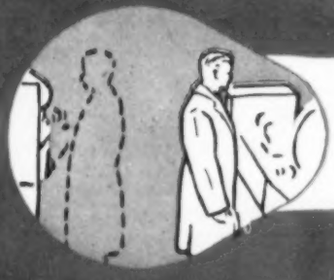
A unique work speed that is ever-changing—insures the most efficient grinding action for cam shapes.



Highly simplified control—movement of one conveniently located lever starts grinding cycle.

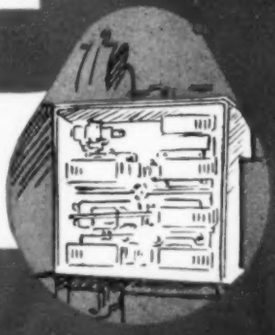
Truing at completion of each shaft is automatic—requiring no effort on the part of the operator.





Automatic features permit operators to tend two—or more—machines at a time.

All hydraulic valves segregated in elevated cabinet at rear of machine for ease of maintenance.



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The new NORTON CAM-O-MATIC* Cam Grinder

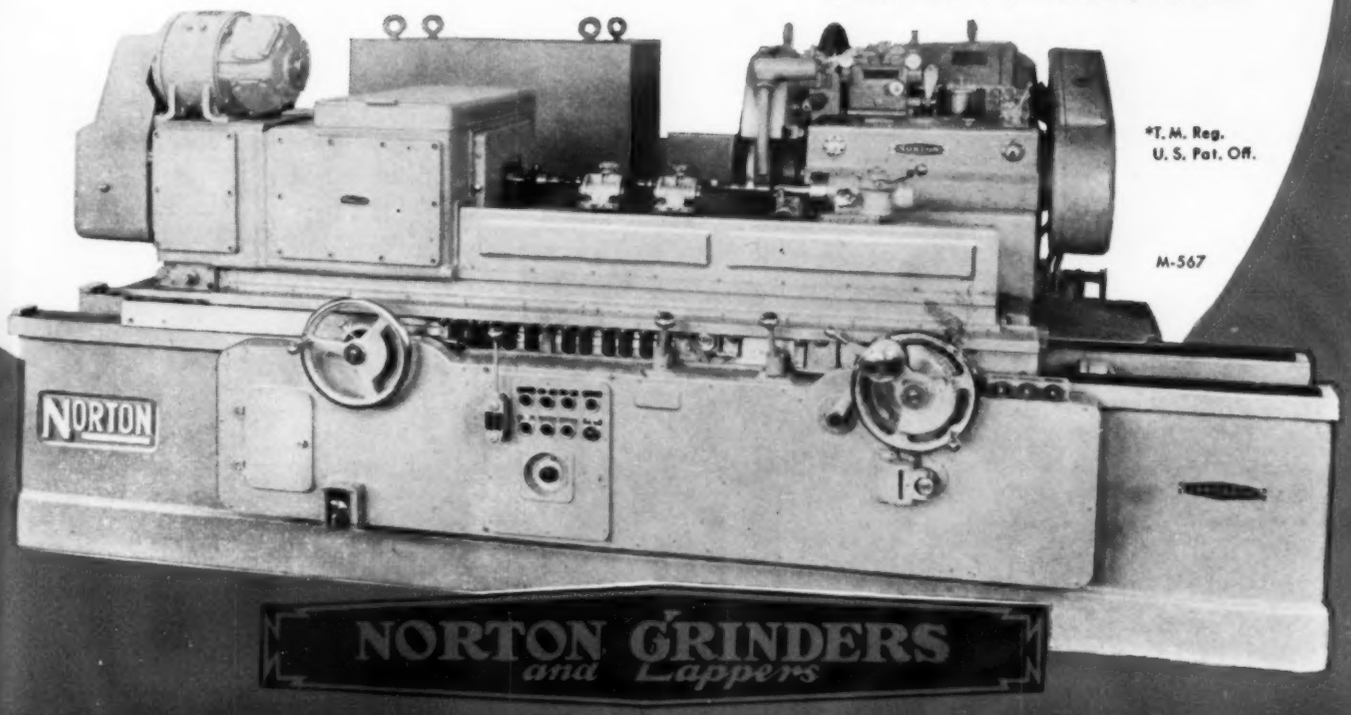
A MACHINE THAT YOU'LL *LIKE* ON YOUR PRODUCTION LINE

YES, you'll really be enthusiastic about the new Norton Cam-O-Matic*—you'll like the finish that it produces on your cams—you'll like the way that its fast, easy automatic operation cuts production costs.

The operator merely loads, starts the grinding cycle by movement of a conveniently positioned lever, then unloads after termination of the automatic cycle. Indexing of the work table and master cam roller and truing of the grinding wheel are all *automatic*. This simplicity of operating effort permits a man to tend two, or even more, machines.

And there's the new ingenious, automatic, continuous variation of work speed as each cam is ground—fast at first for rapid stock removal then slower and slower for a fine finish.

Norton 5" x 30" No. 2 Cam-O-Matic Grinder



*T. M. Reg. U. S. Pat. Off.

M-567

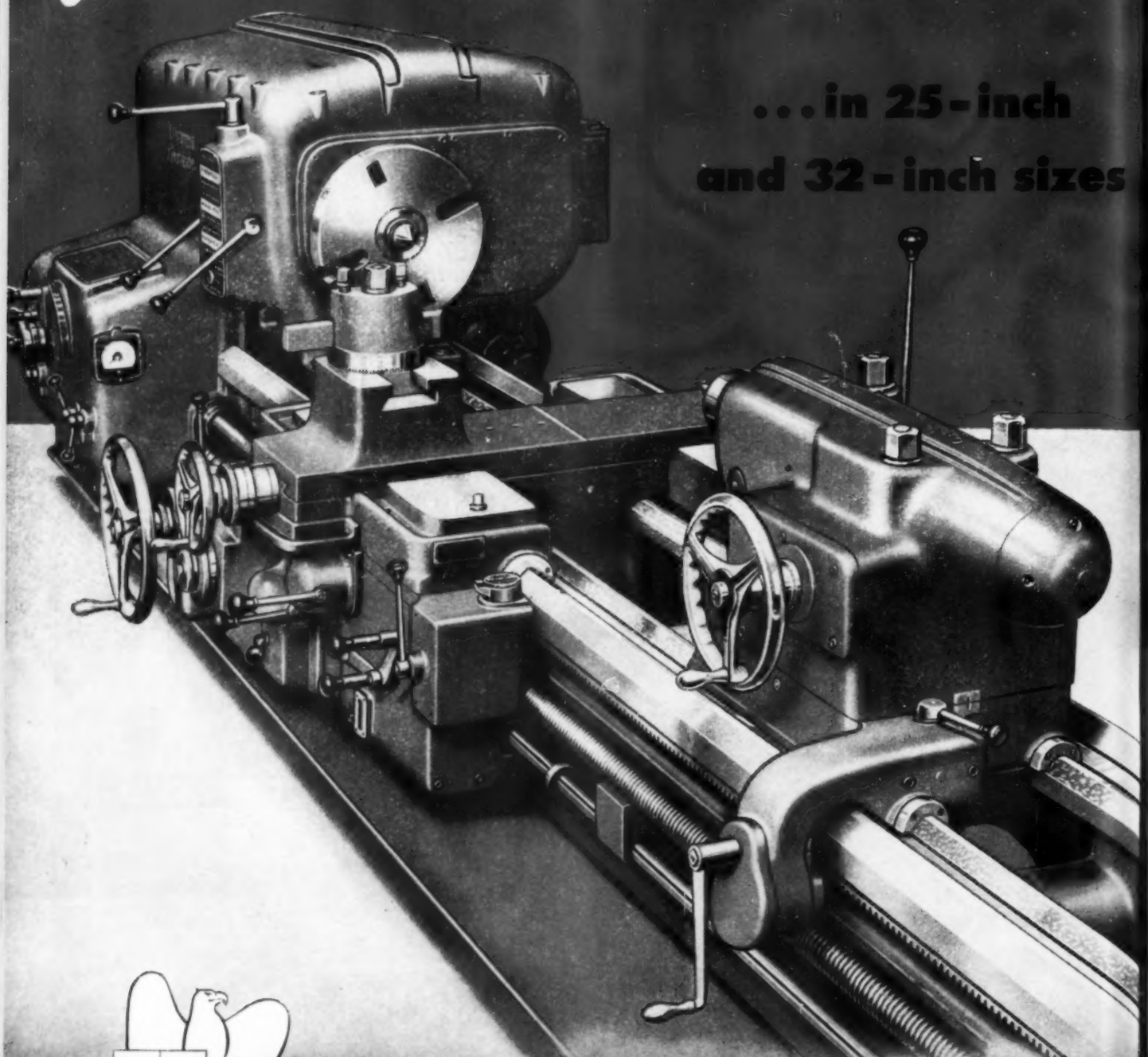
NORTON GRINDERS *and Lappers*

NORTON COMPANY, WORCESTER 6, MASS. · New York · Chicago · Detroit · Cleveland · Hartford · Distributors in All Principal Cities

The Lathe of Tomorrow...

Now— a New PACEMAKER

...in 25-inch and 32-inch sizes



THE AMERICAN TOOL WORKS CO.

at your Service Today!

HIGHLIGHTS OF PACEMAKER EXCELLENCE

1. Designed for full overload of 40 horse power motor.

2. Generously proportioned with metal correctly distributed to insure continuous service at maximum loads.

3. 27-speed head providing 100 to 1 ratio with speeds 6 to 600 RPM.

4. Spindle rigidity increased 16 times by center bearing. Front and center Timken Precision Bearing adjustable in thousandths from outside of head. The additional rigidity provided by the center bearing insures minimum spindle deflection under heavy stresses, thus maintaining pitch line contact of driving gears resulting in longer life of gears and bearings and freedom from excessive noise.

5. Entire machine automatically oiled; all gears hardened and ground or machine lapped; all shafts hardened and ground; spindle speeds, feeds and threads direct reading.

6. Machine started, stopped, braked, jogged and reversed electrically from convenient lever at right-hand side of apron.

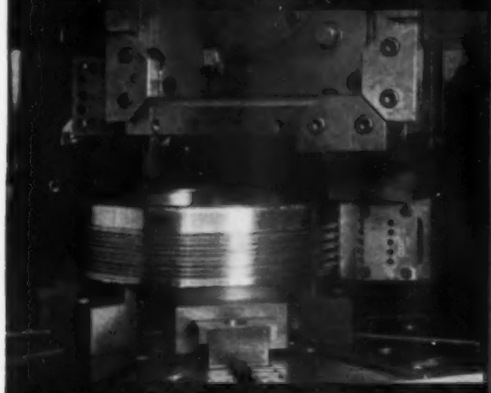
7. Extremely massive bed designed to extrude chips through vents in rear wall.

8. Get all the facts about this ultramodern superproductive lathe . . . send for Bulletin No. 25.

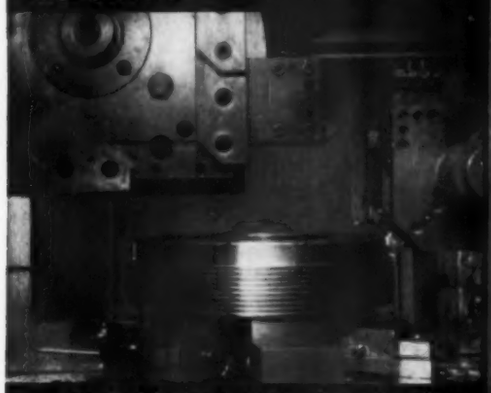
Cincinnati, Ohio U.S.A. LATHES AND RADIAL DRILLS

Here's the brake drum ready for the outside diameter and radius turning operation. The inside has already been semi-finished.

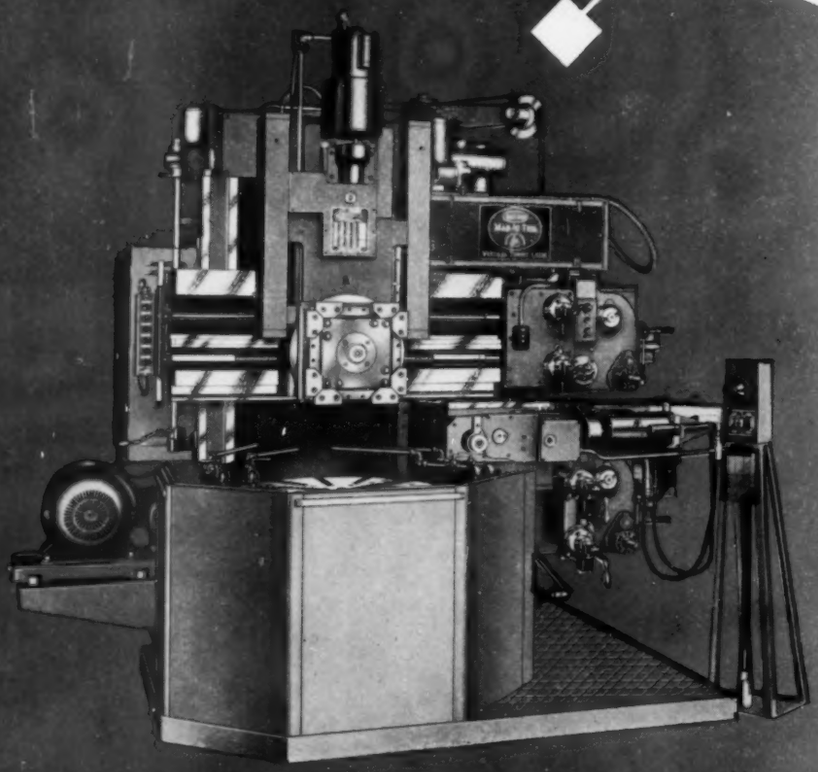
This is the first finning operation—finish turn OD of fins and semi-finish turn shoulder diameter—face flange and form shoulder radius and rough cut fins.



Here Man-Au-Trol utilizes the angular turning attachment to generate the top surfaces of the fins. 5 cutting tools instead of 3 are working simultaneously as in the roughing operation.



This is the final finning operation—the under surfaces of the fins are generated, using 5 cutters in the turret head, while side head turns the shoulder.



BULLARD 30" Man-Au-Trol Vertical Turret Lathe versatility solved a brake drum problem for Copperweld Steel Company Brake Drum Division. It reduced the machining time for their delicate finning operation from 80 minutes per drum for the only previously successful method to 18 minutes per drum. The Man-Au-Trol method not only successfully provided a finning method, but also took additional cuts not previously possible without additional set-ups.

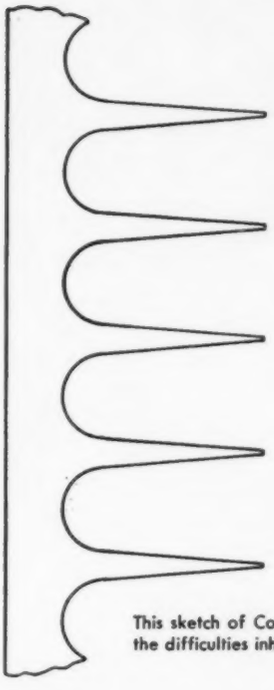
Several of the Man-Au-Trol functions are pictured and described on the accompanying close-ups.

BULLARD CREATES *NEW*

BULLARD MAN-AU-TROL

PRODUCES

UNIQUE *Copperweld* BRAKE DRUMS MORE THAN 4½ TIMES FASTER



This sketch of Copperweld Brake Drum fins illustrates the difficulties inherent in this job.

BULLARD MAN-AU-TROL MASTER OF THE MACHINE

You, too, can set new production records with BULLARD Man-Au-Trol Vertical Turret Lathes. No other machine combines productivity, versatility and accuracy on such a lavish scale. Bulletin MAV-G-1 proves it. Write for your copy today. THE BULLARD COMPANY, Bridgeport 2, Connecticut.

METHODS TO MAKE MACHINES DO MORE

HOW SIDE BARS FOR "Chabelco" DRIVE CHAIN

½" THICK SIDE BAR FOR "Chabelco" DRIVE CHAIN

REAR VIEW OF DANLY PRESS

7 TIME- AND COST-SAVING FEATURES OF DANLY PRESSES

DANLY

PRECISION DIE SETS . . . STANDARD AND SPECIAL

ARE PRODUCED *at a rate of* 1200 *per hour*

on a DANLY *400-Ton* STRAIGHT-SIDE PRESS

JOB DATA

Overall Size of Piece: 6¼" x 2⅛" x ½".

Stock: SAE 1335 Steel—½" thick, 2⅛" wide.

Operations: Pierce one 1 3/16" round hole and one straight-side hole 1 3/16" x ⅜", trim ends and sides.

(At left) Scrap is blown out of die through special shoot. Blanked pieces drop through cavity provided in bed of press. Power conveyor installed below bed discharges finished pieces in drum container.

- **New Ventilated Floating Disc Air Friction Clutch** increases flywheel energy—gives long, trouble-free service under severe operating conditions.
- **Built-In Automatic Filtered Oiling System** puts right amount of oil where needed—*including flywheel bearings*. Eliminates sludge—increases press life—conserves oil.
- **Sturdy All-Steel Welded Frame**—All weldments stress relieved before machining—insures accurate, permanent alignment.
- **Pitman Wrist-Pin Design**—Permits precision fitting of component parts, assures closer operating tolerances, promotes longer press life.
- **Air Pressure and Oil Pressure Safety Switches**—Safeguard press, prevent operation should pressures drop below safety point.
- **Safe, Convenient Electrical Controls**—Save time on die adjustments and add safety to trial strokes.
- **Balanced Flywheel, Balanced Clutch and Air Counterbalanced Slide**—Insure quiet, smooth-running performance.

One of nine Danly Presses at Chain Belt Co., Milwaukee, Wis., this 400-Ton, Straight-Side Unit speeds output of ½" thick side bars for "Chabelco" drive chain. A production rate of 1200 pieces per hour is attained with one operator at a press speed of 20 strokes per minute. The job is set up with a two-stage progressive die on a Danly Precision Die Set. Sixteen-foot lengths of ½" x 2⅛" SAE 1335 steel strips are fed by hand.

Tolerance of .003" held—Setup time reduced

The finished pieces are held to a tolerance of .003" on the hole centers. Accuracy of .010" is maintained around the blanked outline.

Setup time for this and other jobs is greatly reduced by reversible slide controls on the Danly Press. Because the press can be stopped at any point of its stroke *and quickly reversed* by push-buttons, die adjustments are made in a fraction of the time usually required.

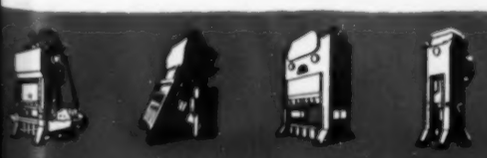
Other important advantages

The Danly exclusive ventilated air friction clutch which contributes to flywheel energy, and the complete built-in circulating oil system are other important Danly features which help to further reduce press downtime, increase production, and cut costs.

WRITE FOR MORE FACTS

Write today for free bulletin describing Danly's new and exclusive press engineering features. Find out how Danly Presses can help you cut costs and increase production. For free engineering assistance, send details about your problems. You will receive specific recommendations without obligation.

DANLY MACHINE SPECIALTIES, INC.
2100 SOUTH 52ND AVENUE, CHICAGO 50, ILLINOIS



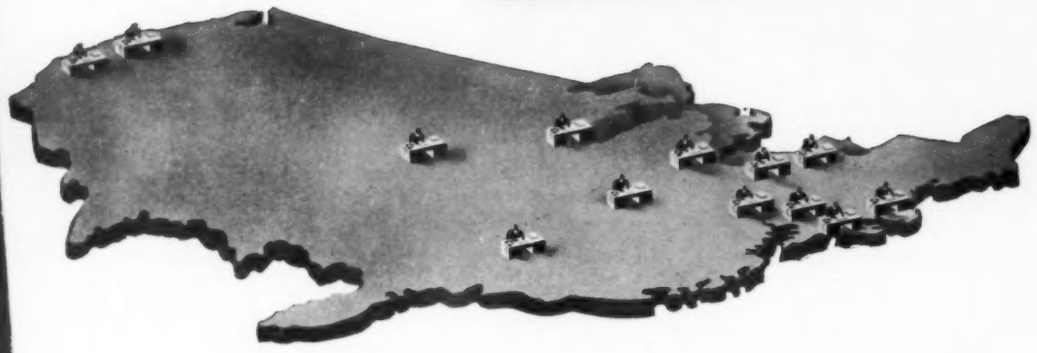
25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

MECHANICAL PRESSES AND PRESS EQUIPMENT

A BUYING GUIDE FOR ABRASIVES

ABRASIVE PROBLEM:

Can Technical Assistance be easily obtained?

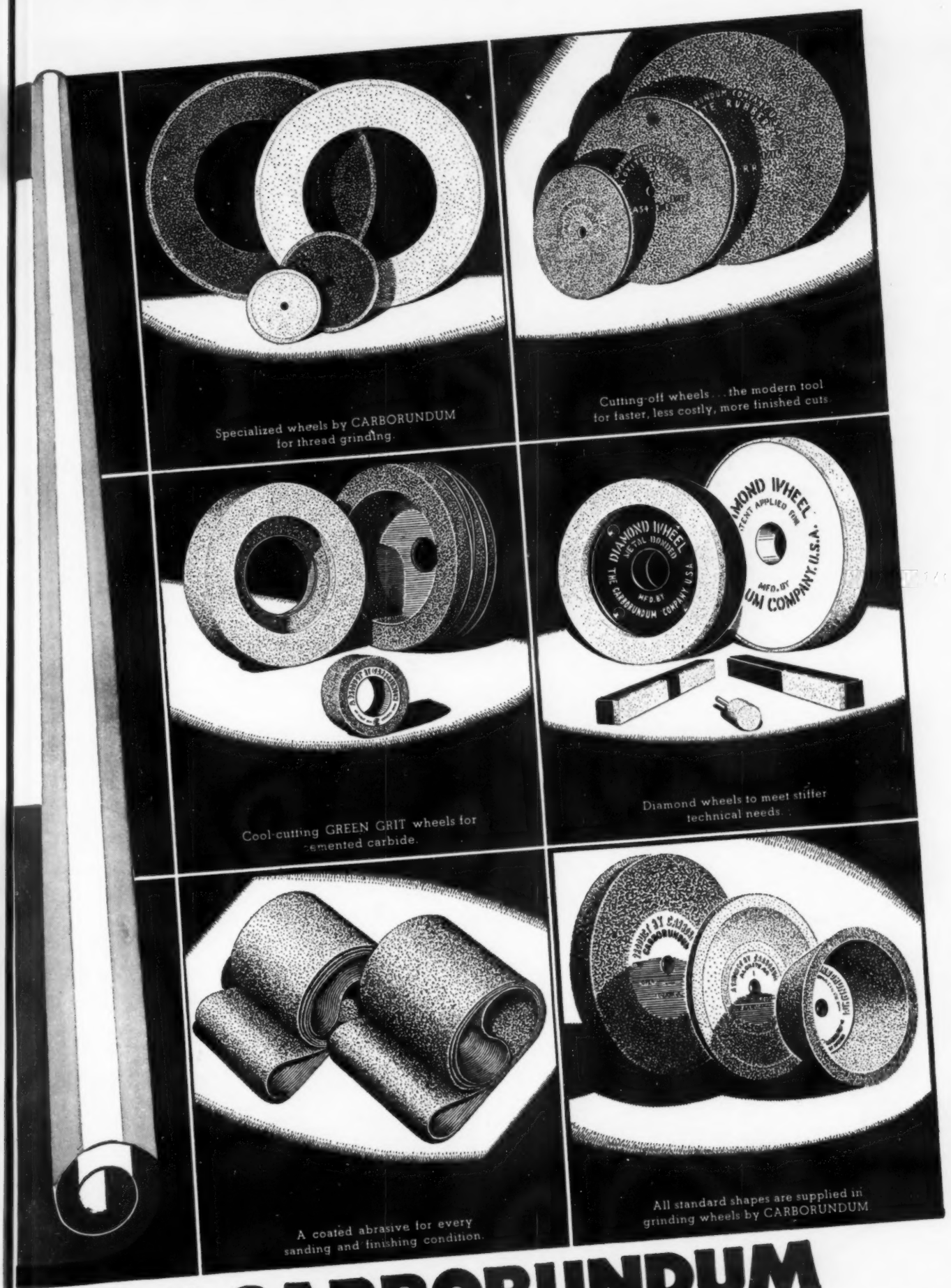


ANSWER BY

CARBORUNDUM
TRADE MARK

Through our district organization, located at more than a dozen key industrial centers, users of abrasives are offered direct access to the engineering, research and wide scale technical activities of The Carborundum Company. Staffed by selected men of experience, it is the purpose of this organization to represent The Carborundum Company locally. It is their intelligent handling of abrasive problems and their sincerity in serving customers' needs that makes every user think first of CARBORUNDUM when they think of abrasives. The Carborundum Company, Niagara Falls, New York.

A Good Rule for Good Grinding


Specialized wheels by CARBORUNDUM for thread grinding.
Cutting-off wheels . . . the modern tool for faster, less costly, more finished cuts.
Cool-cutting GREEN GRIT wheels for cemented carbide.
DIAMOND WHEEL
METAL BONDED
MFD. BY
THE CARBORUNDUM COMPANY U.S.A.
Diamond wheels to meet stiffer technical needs.
A coated abrasive for every sanding and finishing condition.
All standard shapes are supplied in grinding wheels by CARBORUNDUM

. . . CALL IN **CARBORUNDUM** TRADE MARK

● BONDED ABRASIVES ● COATED ABRASIVES ● ABRASIVE GRAINS AND COMPOUNDS

see it now!

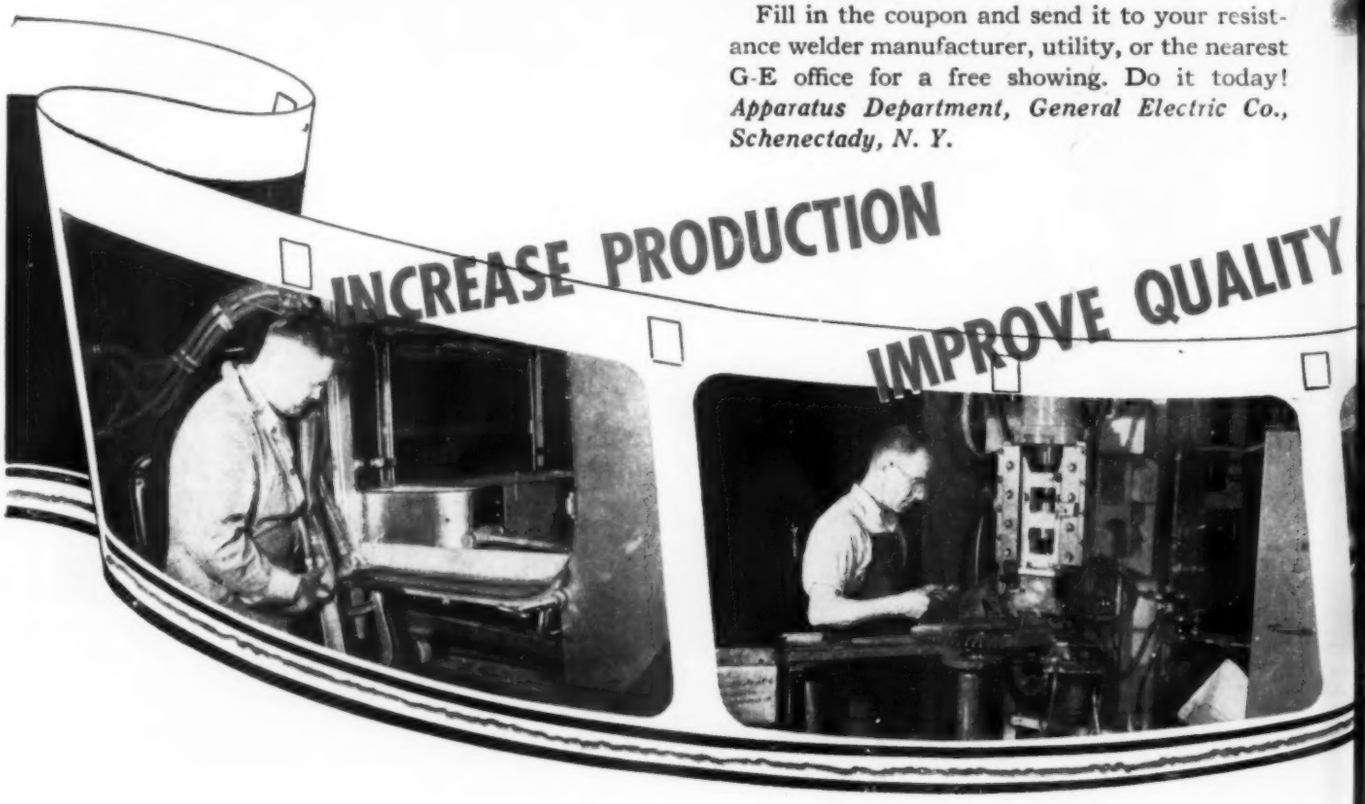
Packed with tips for product designers, resistance welder operators, and production men

SEE HOW successful manufacturers of all types of metal products are utilizing the various types of resistance welding to best advantage. **WATCH** the welding of metal boxes in a plant that now saves $84,000 and 7000 pounds of tin each year with seam welding. **SEE** other equipment such as cabinet trays now being produced at a rate five times that of a former method. **HEAR** how a manufacturer of airplane fuel tanks was able to reduce the weight and produce the tanks at one-sixth the former cost. **YOU, TOO,** may be able to replace seven operations with one as another manufacturer did when he installed projection welding.

Operators will better understand electronic control through the animated cartoons and simplified explanation of the factors (such as the type of material to be welded, its thickness, and electrical resistance) determining the magnitude and timing of current.

At the showing of the film you will also receive a review manual that describes all phases of resistance welding and contains a section of interest to engineers who are faced with increasing power loads.

Fill in the coupon and send it to your resistance welder manufacturer, utility, or the nearest G-E office for a free showing. Do it today! *Apparatus Department, General Electric Co., Schenectady, N. Y.*



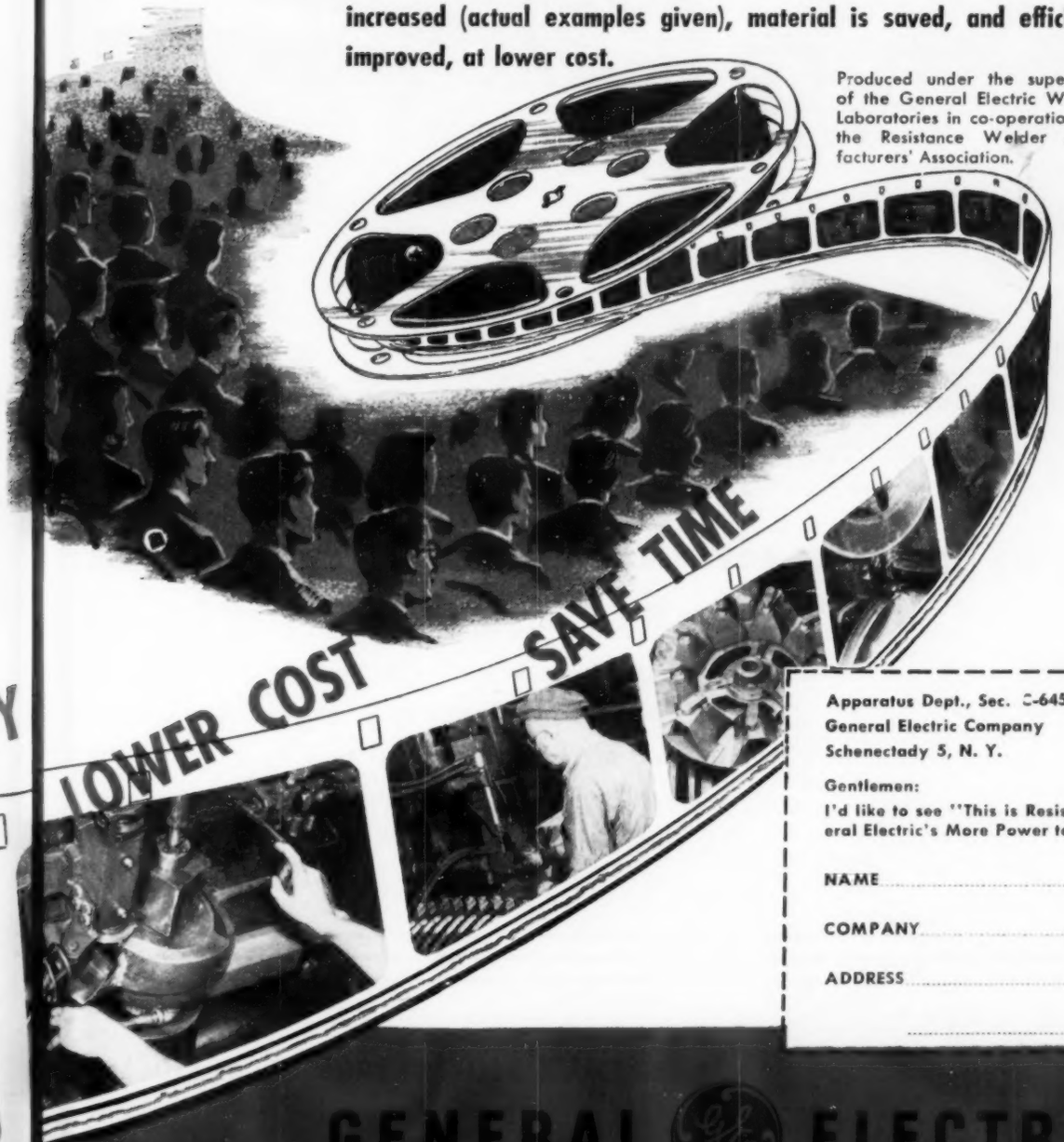
"This is Resistance Welding"

NEW 30-MINUTE, FULL-COLOR, SOUND MOTION PICTURE

DESCRIBES . . . INSTRUCTS . . . EXPLAINS . . .

all phases of resistance welding—spot, seam, and projection. Shows how each type can best be used, how rejects can be cut, production increased (actual examples given), material is saved, and efficiency improved, at lower cost.

Produced under the supervision of the General Electric Welding Laboratories in co-operation with the Resistance Welder Manufacturers' Association.



Apparatus Dept., Sec. C-645-46
General Electric Company
Schenectady 5, N. Y.

Gentlemen:
I'd like to see "This is Resistance Welding," General Electric's More Power to America movie.

NAME .....

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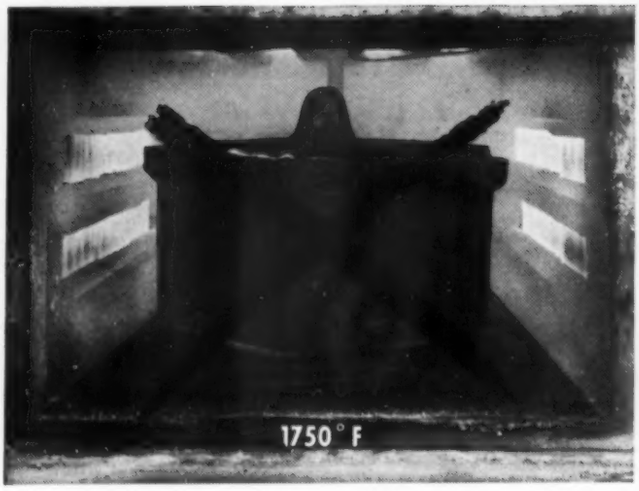
GENERAL ELECTRIC

How This New Air-Hardening Tool Steel

Lowers Your Tooling Costs!

Easy, Low Temperature Heat Treatment!
Uniform Hardening in Very Heavy Sections!


1750° F

1550° F (no pack hardening required)

—and here are the extra advantages you get by using VEGA:

- Minimum Distortion and Size Change
- Resistance to Decarburization
- Freedom from Excessive Scaling in Hardening
- Good Machinability
- High Degree of Toughness with Good Hardness to Resist Shock and Wear.

The Standard Tool Steels of Industry

IMMEDIATE DELIVERY FROM LOCAL STOCKS!

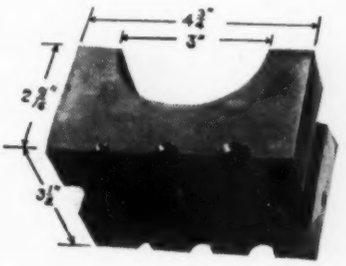
THE CARPENTER STEEL COMPANY • 109 W. BERN STREET • READING, PENNSYLVANIA

In *Vega* you now have an air-hardening tool steel that can be heat treated from a temperature 200°F *lower* than the 5% chromium air-hardening steel! As a result, expensive pack hardening to avoid excessive scaling can often be eliminated. And because the hardening temperature of *Vega* is only 1550°F, you need no special high temperature furnaces.

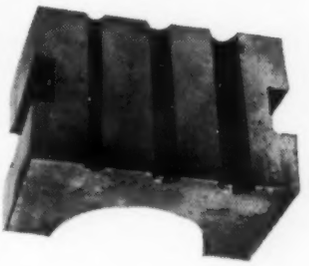
Start now to cut costs on jobs such as blanking, piercing, trimming and forming sheet metal in light and heavy gauges. You can get *immediate* delivery of *Vega* in standard sizes from nearby Carpenter Warehouse or Distributor stocks. For complete information and fast delivery, call Carpenter, today.

VEGA

U. S. Pat. 2,355,224



Start now to get tooling results like this . . .



On these chucking and forming dies, the tool maker wanted easy machining and minimum distortion in heat treatment. The oil-hardening tool steel previously used "opened-up" .030″/.035″ across the 3″ diameter. After using VEGA, over-all expansion was held to .0004″/.0005″—with no evidence of warpage. And in addition, the tool maker had this to say about VEGA: "This steel machines in every respect as well as the oil-hardening tool steel."

Call Your Nearest Carpenter Warehouse or Distributor

Atlanta • Baltimore • Birmingham, Ala. • Boston • Bridgeport, Conn. • Buffalo • Chicago • Cincinnati • Cleveland • Dayton • Detroit • Grand Rapids, Mich. • Hartford • Houston • Indianapolis • Kansas City • Los Angeles • New York • Philadelphia • Providence • St. Louis • Worcester, Mass. • *In Canada:* Toronto • Montreal.

Export Department, 233 Broadway, New York 7, N. Y. "CARSTEELCO"

Carpenter

MATCHED

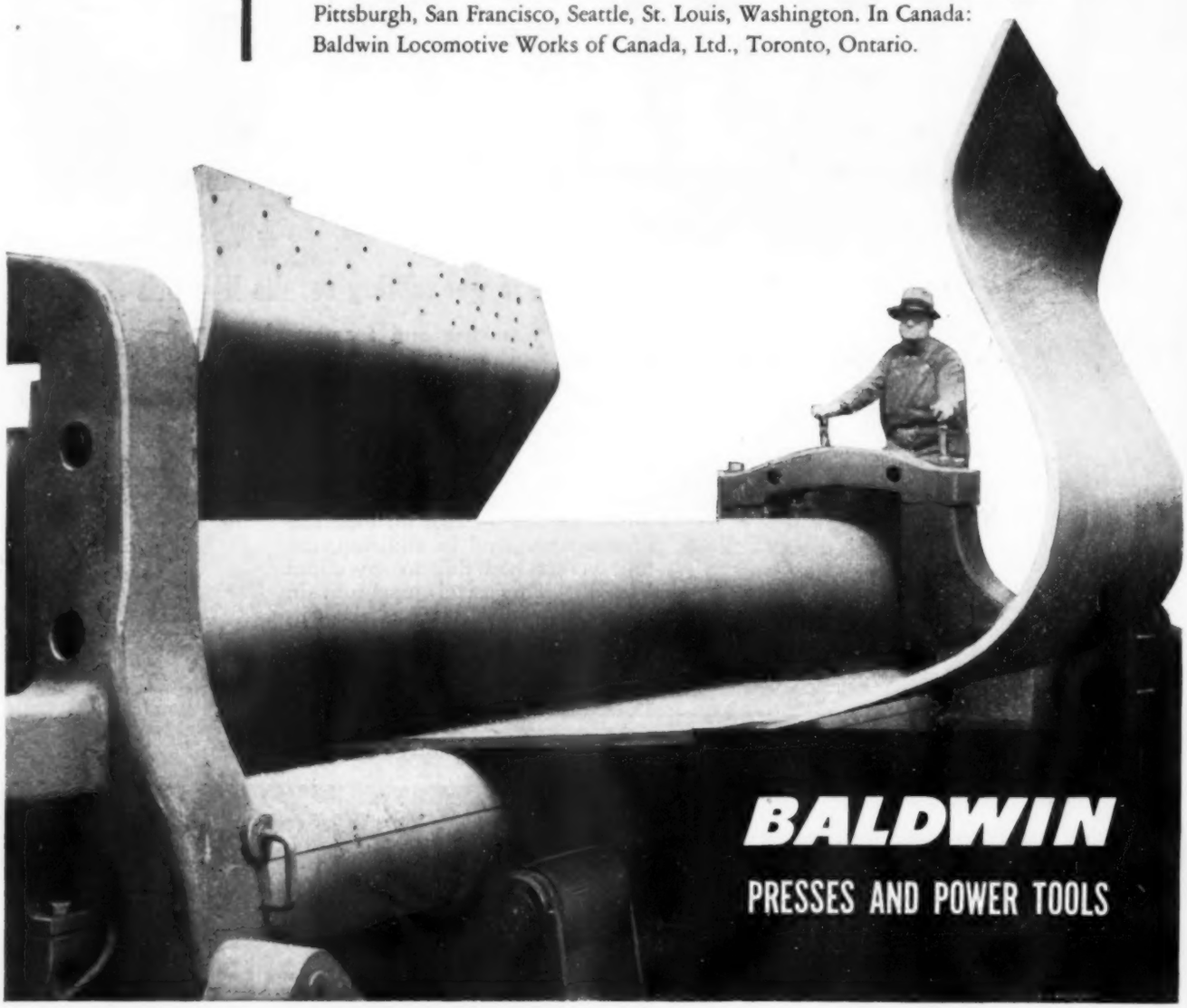
TOOL & DIE STEELS

you can do **tougher** jobs with this Baldwin bending roll

A lot of "impossible" plate bending jobs become possible . . . when you install a Baldwin Bending Roll. Reverse curves, adjacent varying radii, are easier to get *out* of the blue print, and *into* the part.

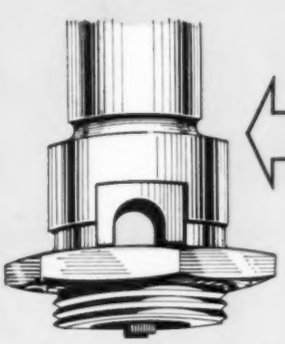
Years of practical engineering experience are reflected in every detail of design and construction. All forces and reactions are taken within the members in which they originate. Power is transmitted through cut-steel spur gears. The nuts and worms of the improved screw-down mechanism operate in an oil bath. One shot lubrication minimizes wear and power waste.

Ask for the new bulletin, No. 278, "Baldwin Southwark Bending Rolls". The Baldwin Locomotive Works, Philadelphia 42, Pa., U. S. A. Offices: Birmingham, Boston, Chicago, Cleveland, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Seattle, St. Louis, Washington. In Canada: Baldwin Locomotive Works of Canada, Ltd., Toronto, Ontario.



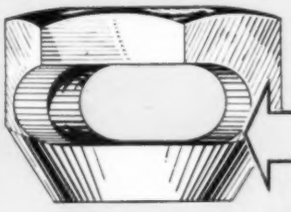
Facts about "ACORN" DIES

The "Acorn" Die has produced billions of threaded parts since its introduction in 1909. It has given superlative performance in thousands of plants where high production, high speed, accuracy and thread quality are all "musts". The reason for its popularity is its simplicity, ruggedness, and accuracy. Its design explains why the "Acorn" fills the bill.



HOLDERS fit any machine. Lock nut sets die at any desired adjustment.

"ACORN" DIE with threaded prongs.



ADJUSTING CAP presses equally on all prongs for easy, accurate adjustment.

TO USE: Just screw up the cap to desired adjustment and turn up the lock nut. A threaded plug comes with each die. This test plug has been threaded by the die with which it is packed and insures the accuracy of your set-up. *"Acorn" Dies are stocked by your "Greenfield" Distributor.*

For the complete story of the "ACORN" DIE write for booklet!

GTD GREENFIELD

World's Leading

THREADING TOOLS

When you buy GTD "Greenfield", you get a quality of product that comes from the world's largest, most modern threading tool plant and its research staff of threading engineers—PLUS SERVICE from the leading distributors and GTD "Greenfield's" field men in every industrial center.

GREENFIELD TAP and DIE CORPORATION GREENFIELD, MASSACHUSETTS

Precision THREADING TOOLS

GEOMETRIC

CLASS S Collapsing TAPS

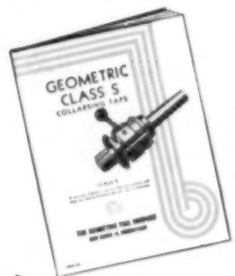
A "Universal" Tap for Jobs Over 1¼"

These famous Geometric taps not only fit almost any machine but will also do almost any internal threading job over 1¼" in diameter.

Finely proportioned, rugged in construction, and simple in operation, each GEOMETRIC CLASS S COLLAPSING TAP cuts such a wide range of diameters and pitches that it will often do the work of two competitive tools.

With a few simple adjustments and without buying additional parts, the S Tap can be converted to Stationary Type, Plate Trip — Rotary Type, Plate Trip — Rotary Type, Sleeve Trip — and Hand or Lever Trip. GEOMETRIC CLASS S COLLAPSING TAPS available for tapping diameters from 15/16 to 8½ inches. In addition to the standard line of S Taps, Geometric also builds many types of Special Taps. If you have a job requiring a Special Tap, put your problems up to Geometric. There's no obligation! *If you have an internal threading job over 1¼" send today for a free bulletin on these famous GEOMETRIC CLASS S COLLAPSING TAPS.*

USE COUPON FOR FREE INFORMATIVE BULLETIN NO. S-3



THE GEOMETRIC TOOL COMPANY
7 Valley Street
New Haven 15, Connecticut

Please rush me a copy of Bulletin No. S-3 which describes in detail the many advantages of the Geometric Class S Collapsing Tap.

*Name*_____

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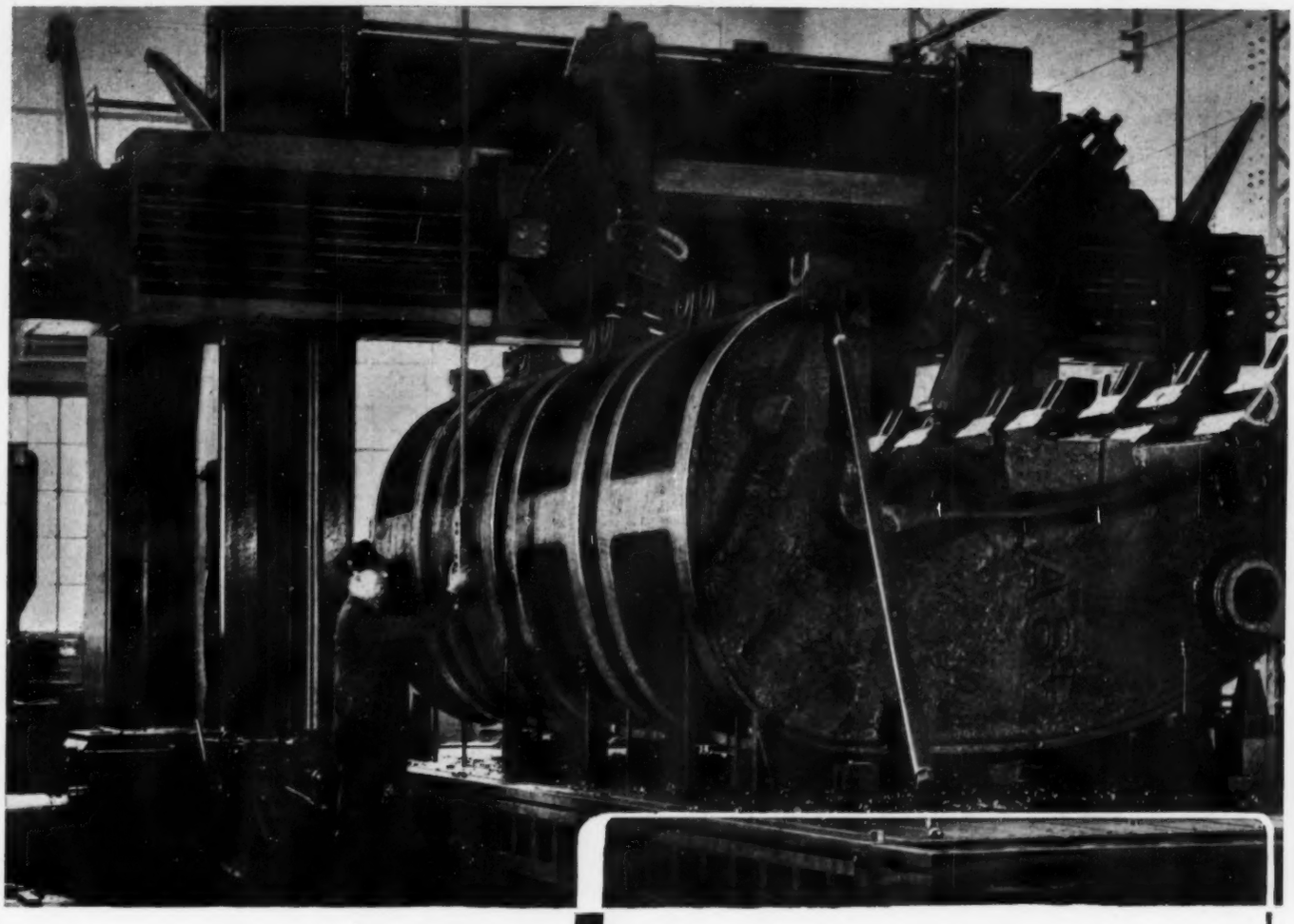
*City*_____ *Zone*____ *State*_____

GEOMETRIC

TO

For HEAVY PRODUCTION



it's the new GRAY PLANER

Deep roughing cuts in steel and cast iron demand tremendous power and rigidity.

The 12 ft. x 10 ft. x 30 ft. Heavy Duty GRAY PLANER shown above is in daily production service — year in, year out. Multiple head planing of large Niagara Press columns requires a rugged yet accurate planer.

Production, too, requires convenience of operation—on a new GRAY, one man does the job regardless of its size.

If your production is limited by expensive, slow speed planers, investigate the new GRAY.

Write for our Bulletins describing all the latest GRAY production features

The G.A. **GRAY** *Company*

planers • milling planers
planer type milling machines
horizontal boring machines

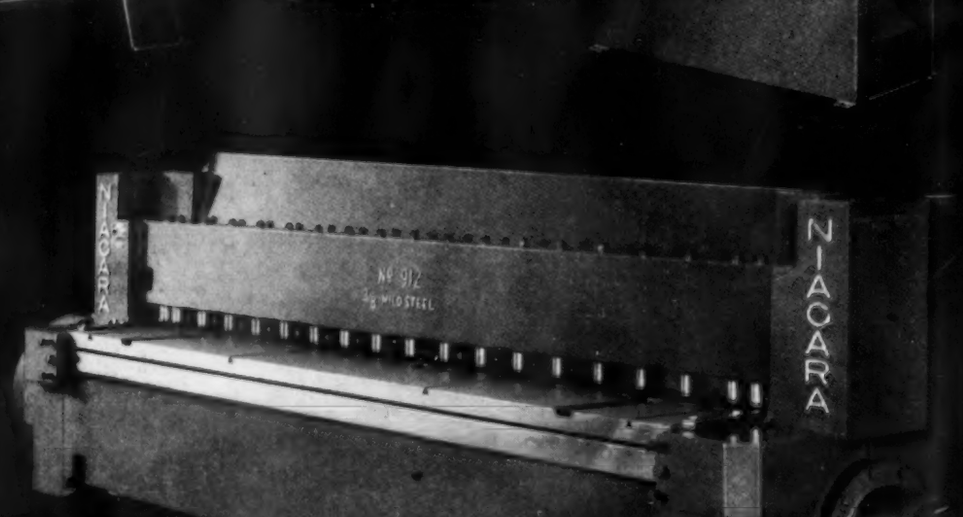
CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

FOR ADVANCED DESIGN *look into....*

NIAG

Niagara Double Crank Press

Niagara Deep Throat Press



Niagara Underdrive Shear

NIAGARA MACHINE AND TOOL WORKS, BUFFALO 11, N. Y

NIAGARA

● The modern design of Niagara Presses, Shears and other machines for plate and sheet metal work is proof of the Niagara talent and experience that is built into them. Men responsible for economical production appreciate these results of Niagara engineering,—high hourly output... convenient operation... accurate work... reliable, uninterrupted performance with minimum down time... low maintenance cost.

Write for Bulletins

Niagara Double Crank Gap Press

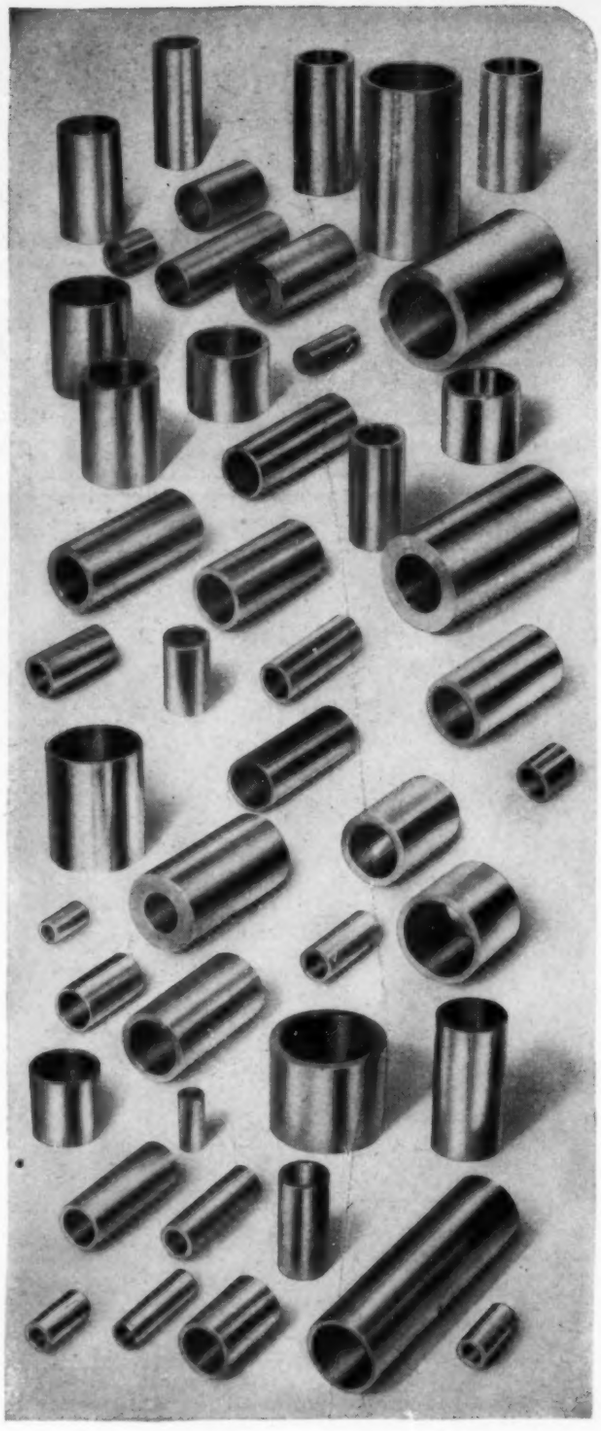
America's most complete line of

PRESSES, SHEARS, TINNERS TOOLS AND MACHINES FOR PLATE AND SHEET METAL WORK

District Offices: Detroit, Cleveland, New York

1088 SIZES OF FULLY FINISHED, READY-TO-USE

BUCKEYE BEARINGS



Carried by Leading Distributors for Your Convenience

● Leading supply houses carry Buckeye Bearings to serve you better. Manufactured from selected materials under our rigid laboratory and metallurgical controls of charging ratios and melting and pouring temperatures, Buckeye Bearings meet the most exacting specifications. Each is a quality product—free from porosity and accurately dimensioned within the required limits assuring speedy, easy assembly and a maximum of long, efficient, satisfactory service. Send for the Buckeye catalog, and order Buckeye quality bearings—by name and number—from the stocks that are carried by your Buckeye distributor.

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BRASS AND MANUFACTURING COMPANY

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BRONZE SLEEVE BEARINGS • STANDARD SIZES OR TO CUSTOMERS' BLUEPRINT IN ANY RECOGNIZED BEARING METAL ANALYSIS

THE BEST OF INSPECTION EQUIPMENT...

Photograph courtesy The Abdite Gauge Co., Dearborn, Michigan

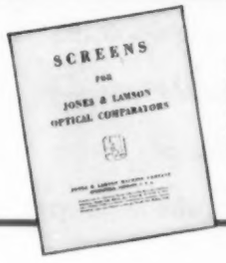
Inspecting tiny six-spline ring gauges at 100 magnifications on a Jones & Lamson Optical Comparator and Measuring Machine. All tolerances plus or minus .0002".

The finest workmanship can only be gaged by the finest inspection equipment. The Abdite Gauge Company, maker of precision gauges, uses a Jones & Lamson Comparator to inspect these tiny six-spline gauges. The splines are .028" wide and all dimensions are held to .0002". Any departure from these close tolerances is immediately and clearly visible on the screen of the Comparator.

Inspection with Jones & Lamson Comparators leaves no room for doubt; the evidence is positive, conclusive and clearly visible.

Many components and products formerly inspected by slow tedious methods, that retarded production and drained profits, are now inspected in seconds or minutes on Jones & Lamson Comparators, by operators with only a minimum of instruction. Savings are made all along the line, in gage cost, in time and in overhead.

Our engineers are inspection specialists; their knowledge of holding fixtures, handling methods and suitable Comparator equipment has saved hundreds of thousands of dollars throughout the country. Call, write or wire for their services today.



Every owner of a Jones & Lamson Optical Comparator should have this catalog of Standard Glass Screens. Write to Dept. 710 for your copy.

Optical Comparator Division

JONES & LAMSON MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

WINTER BROTHERS TAPS ARE DEPENDABLE

Winter Taper Pipe Taps are designed to provide the close tolerances essential in tapping pipe fittings. Like other Winter Taps, they give you cleaner threads, longer service between grinds, and extra tap life.

Always at Your Service

YOUR LOCAL DISTRIBUTOR carries a complete stock of Winter Taps on his shelves—as close to your tapping problems as the telephone on your desk.

● When you buy Winter taps, you get more than a fine tool. Competent, trained Winter Engineers are at your call from stations throughout the country. These men can draw upon the accumulated knowledge of the entire Winter organization—close to a half century of tapping experience—in answering your questions. Call on your Winter Engineer whenever a troublesome tapping problem may arise.

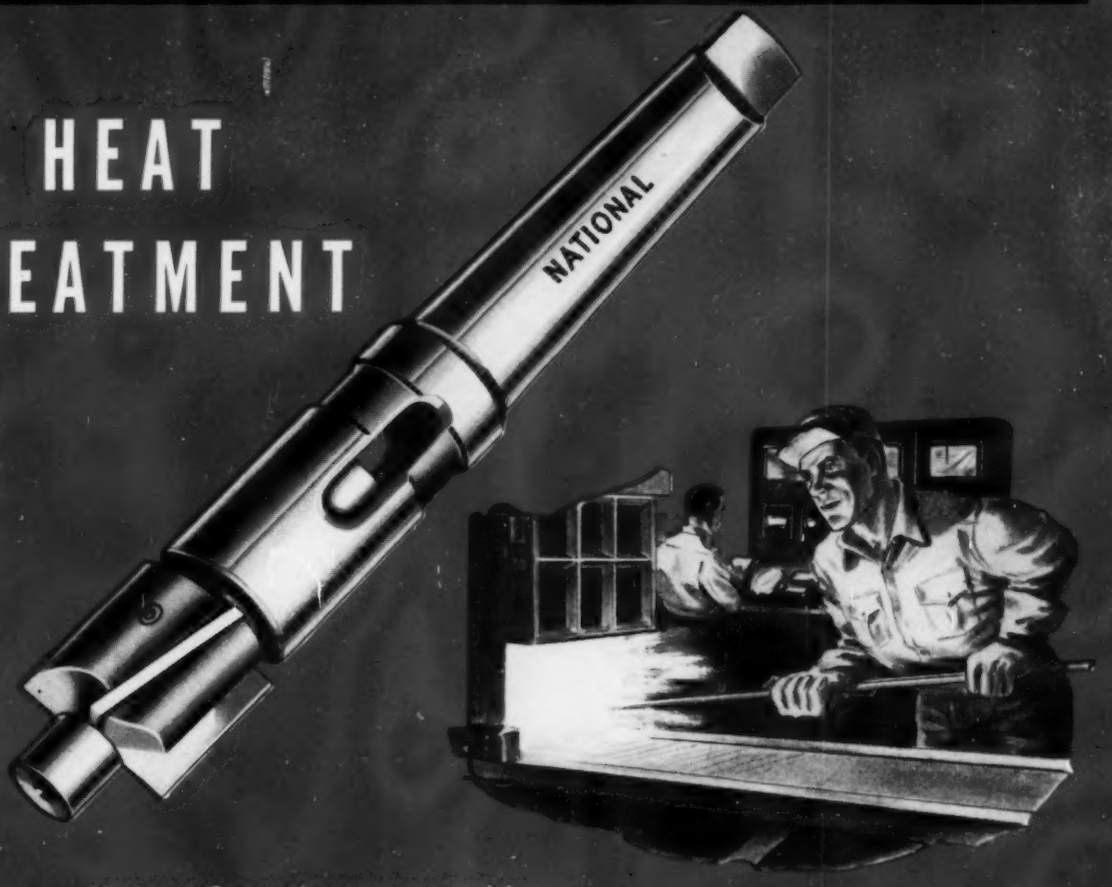
Winter Brothers COMPANY

ROCHESTER, MICHIGAN, U.S.A. • Distributors in Principal Cities • A Division of the National Twist Drill and Tool Company • Branch Stores: New York, Detroit, Chicago, San Francisco

WINTER

PERFORMANCE IS BUILT INTO NATIONAL METAL CUTTING TOOLS

HEAT TREATMENT



National Counterbores are noted for their rugged construction, simplicity of design, and adaptability to a wide variety of operations. The complete National line also includes Twist Drills, Reamers, Milling Cutters, End Mills, and Hobs.

● Scientifically exact heat treatment is an important factor that assures you better performance from National metal cutting tools. At the new National plant, this critical step in quality tool manufacturing is closely controlled and safeguarded by the use of the best equipment obtainable. This applies to furnaces as well as to time and temperature controls. No important operation relies on the human element.

Call Your Distributor

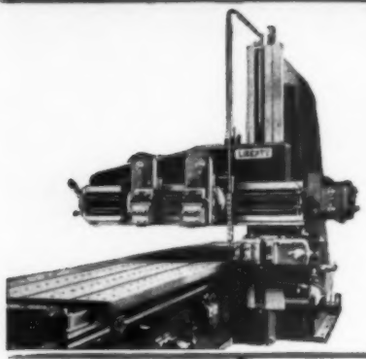
LEADING DISTRIBUTORS EVERYWHERE offer complete stocks of NATIONAL Cutting Tools. Call them for cutting tools or any other staple industrial product.

NATIONAL TWIST DRILL AND TOOL COMPANY

ROCHESTER, MICHIGAN, U. S. A. Tap and Die Division—Winter Bros. Co.

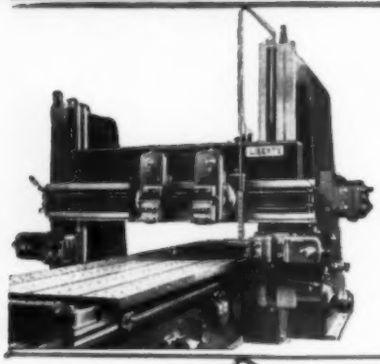
Distributors in Principal Cities • Factory Branches: New York • Chicago • Detroit • Cleveland • San Francisco

LIBERTY BUILDS 3 great PLANERS



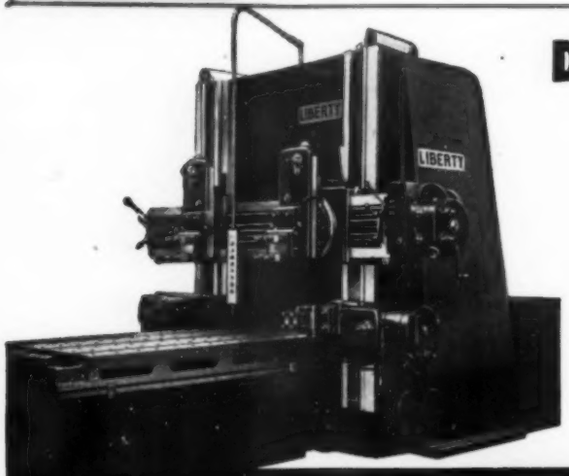
OPEN SIDE

For shops handling work of variable widths. Wide-faced housing and motorized clamp give rigidity for heavy roughing cuts and finishing. Dual control; electric feeds; rapid traverse to all Heads in all directions.



CONVERTIBLE

For exceptional rigidity on variable widths. Two, three or four heads. Offset heads permit closest approach of tools. Double balanced driving gear and pinions. Extreme accuracy.



DOUBLE HOUSING

For rapid production combined with accuracy. Two, three or four heads. Extremely rigid; handles production work with maximum cutting feeds and speeds. Table pulled into tool. Electric clamping and dual control for ease of operation; high production.

Write for catalog giving complete details.

All lengths, 24″ x 24″ wide and larger.

LIBERTY PLANERS, INC.
HAMILTON, OHIO

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 W. MADISON ST., CHICAGO 6

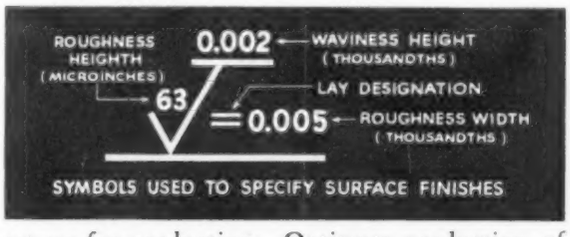
Exclusive Representatives in All Principal Cities

What's in
VERMONT
this month?

"FOURTH DIMENSION" IN GRINDING. The three lineal dimensions used to specify length, width, and height are the foundation of interchangeable parts manufacture. They are also important for manufacturing economy because no part need be made more accurately than its use demands. Close tolerances are specified only when needed, because of high cost.

American industry is now rapidly adopting a "fourth dimension"—a method of specifying tolerances for surface finish. This new "dimension" has the same advantages as lineal tolerances. Engineers can now specify finish to fit each requirement. Production men can now machine parts to specifications without wasting time and money getting a finish "a little better just to make sure."

Bryant Chucking Grinder Company has designed its line of internal grinders so that the "fourth dimension" as well as lineal tolerances can be considered when the machines are being



set up for production. Optimum production of parts to specified size and surface finish can be maintained by means of adjustable feed rates.

This is an example of how machine tool builders are helping engineers and production men get the most for each dollar.

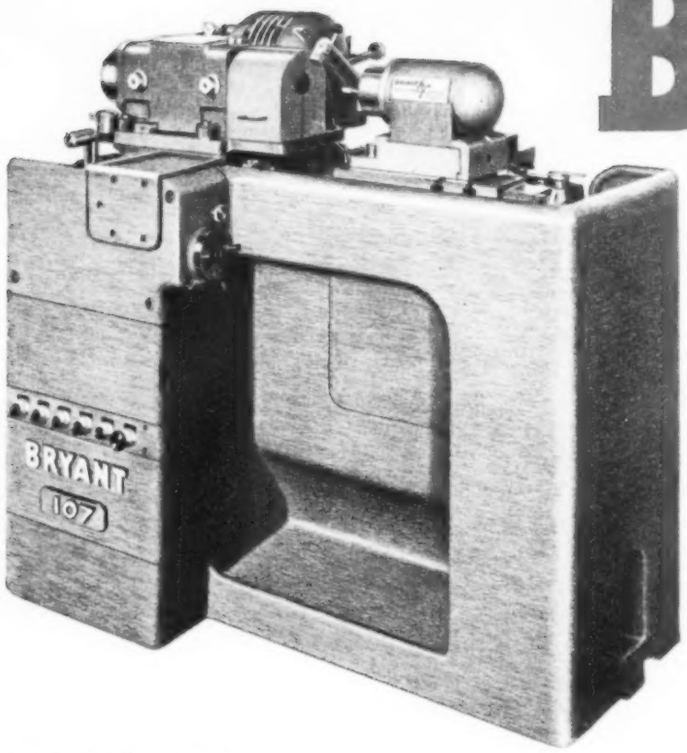
It won't cost to inquire.

Bryant Chucking Grinder Co., Springfield, Vermont, U.S.A.

BRYANT

Number 107

INTERNAL GRINDER



The No. 107, with Bryant Hi-Frequency Wheelhead, is the smallest internal grinder in the Bryant line. Other Bryant equipment will grind holes through the complete range up to 60-inch diameter swing. Write to the factory for full information.

SPECIFICATIONS

Total swing	9 inches
Will grind bore diameters	⅛ to 3 inches
Maximum traverse	6 inches
Maximum hole depth	4 inches
Will grind included angle	90°
R.P.M. of work spindle	200 to 2,400 R.P.M.
Net weight	2,500 lbs.

Floor space — 60 inches x 50 inches (with coolant tank)

SLIDES
Preloaded ball slides for both cross and longitudinal motion.

WORKHEAD
Ball bearing spindle, variable speed electric drive, 200 to 2,400 R.P.M.

WHEELHEAD
Ball bearing, speeds up to 100,000 R.P.M.

TRAVERSE
Mechanical, powered by variable speed electric motor.

CROSS FEED
Powered by variable speed electric motor.

POWER
Standard A.C. current.

NEW BRYANT 3-FLUTE TAP GAGE quickly determines lead, thread form and size of thread that tap will cut. Large dial indicator calibrated in "tenths." Can be used for inspecting 3-flute taps with or without radial relief and for threaded parts of the same diameter and pitch. Write for details.

You can *"See the Difference"* with a BRYANT GAGE

It is no longer necessary to "feel for fit" with plug and ring gages when inspecting threads. The Bryant Thread Gage shows, on a dial indicator, whether a thread will assemble properly with its component.

At a glance, anyone can compare threaded parts with a master and tell the whole story immediately — size, presence of burrs, out-of-roundness, accumulated inaccuracies of pitch, lead, diameter and thread form.

It's fast too. The design incorporates three thread segments, two stationary and one movable. The segments are operated by a thumb lever — the part is dropped between the segments — the lever is released, causing immediate contact of segments to threads — a one third turn of the part inspects it all over.

Send samples or drawings for a complete story on how Bryant can save inspection money for you.

Bryant Chucking Grinder Co., Springfield, Vermont, U.S.A.

Speed Changes are Quick, Exact with *Vari-Pitch* Sheaves!

Speed to Fit the Job! These roller mills, equipped with *Texrope Vari-Pitch* sheaves for motion control can be set instantly to exact speed for best production under all operating conditions. Can you profit by accurate speed control? *Texrope Vari-Pitch* drives are simply and economically applied to machine tools, pumps, blowers, conveyors or other machines.

Save Money With "Pre-Engineered" Texrope Drives

You can solve 90% of all V-belt drive problems, from 1 to 150 hp, with economical stock *Texrope* V-belts and sheaves. The *one best* drive is selected quickly and simply from a new 144-page manual listing 22,000 "Pre-Engineered" drives. Bulletin 20B6956. ALLIS-CHALMERS, MILWAUKEE. *Texrope, Super-7, Texsteel, Texdrive, Magic-Grip* and *Vari-Pitch* are Allis-Chalmers trademarks.

A Complete Range of Products		
Super-7 V-belts	5 types . . . sizes to suit every power transmission job	
Texsteel, Texdrive, Magic-Grip	Sheaves in a full range of sizes and grooves	
Vari-Pitch Sheaves	Exact variations in speed — Stationary or Motion control	
Speed Changers	Speed variations up to 375% at the turn of a crank	

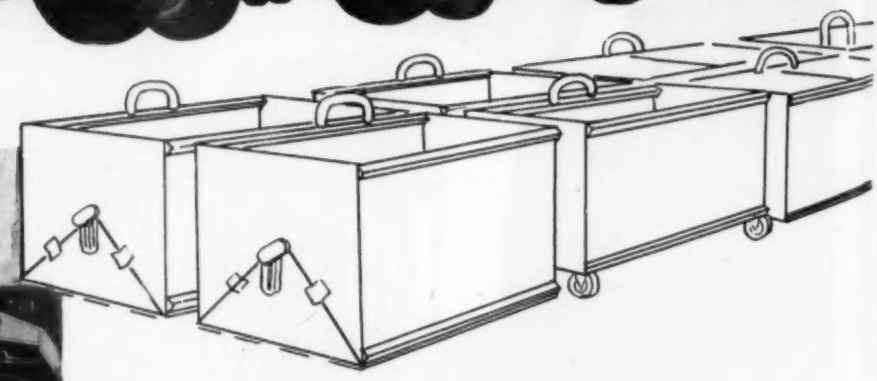
Texrope Super-7 V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

A 2428

ALLIS-CHALMERS

Originators of the Multiple V-belt Drive for Industry

THESE FOUR TRUCKS HANDLE 88 CONTAINERS OF 15 DIFFERENT TYPES



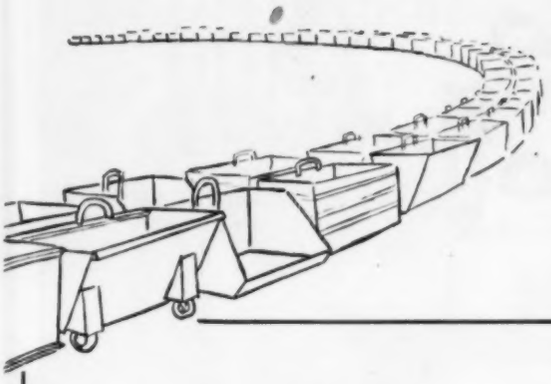
Like many industrial operations, this refinery extends over many acres and handles great quantities of materials, in addition to hundreds of cubic yards of scrap and rubbish daily. Choosing strategic points for receiving material, the 88 containers were placed throughout the refinery, the requirements at each point determining the size and number of containers to be used. At some points for liquid, water-tight containers with lids were required. At others, light, bulky waste called for a big capacity, light-weight enclosed container. Some accumulation points were inside buildings. Containers on casters that could easily be rolled indoors were provided. Each container is assigned to one of the four truck hoisting units and, on a synchronized schedule, is picked up as soon as it is filled. Photos at left show: top-truck hoisting unit backing up to a 6 cu. yd. Universal container. The driver attaches two chains, and then, from controls in the cab, the container is hydraulically lifted into carrying position (see photo at left center). Arriving at the disposal area, the container is automatically dumped (see photo left below). The container is then returned to its original point for reloading and the truck hoisting unit moves on to the next container on its route. Pick-up and dumping operations require only a matter of seconds, thus it is possible for one man and one truck to handle any number of containers, keeping a steady flow of material moving without waiting or wasting time.

On opposite page are illustrated the types of containers in the original installation and the materials they handle. Note how easily the basic Dempster-Dumpster containers are converted for special purposes by the simple addition of lids, casters or some other special change.

The Dempster-Dumpster system is saving money in large and small plants alike. Its great flexibility makes it adaptable to any plant, regardless of size, and assures tremendous savings along with amazing improvements in efficiency. A survey of your plant, without charge or obligation, could reveal the amazing effectivencss of the Dempster-Dumpster System.

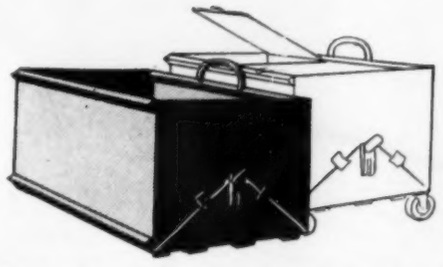
DEMPSTER BROTHERS, Inc.

. . . THIS IS THE DEMPSTER-DUMPSTER SYSTEM . . . SAVES THIS REFINERY $58,000 ANNUALLY

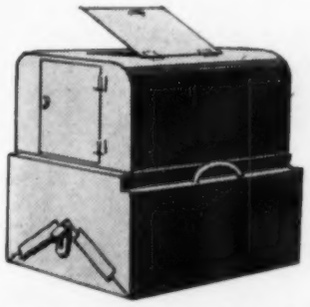


The Dempster-Dumpster System of Materials Handling, simply stated, permits the use of any required number of detachable containers, of various designs and capacities, to be serviced by a single truck. Its ability to effect tremendous savings in handling numerous types of materials has been definitely established in hundreds of leading industrial plants.

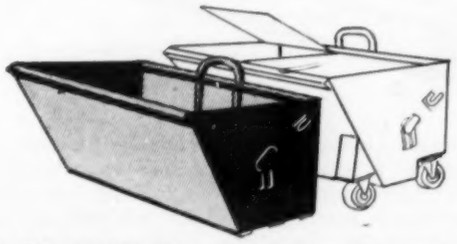
In this particular case, in a large refinery, four of the twelve trucks formerly detailed for materials handling, including scrap and rubbish collection, were equipped with Dempster-Dumpster Hoisting units to handle 88 detachable containers of 15 different types. The Dempster-Dumpster System of quick pick-up and dumping of pre-loaded containers has worked wonders in efficiency, plant appearance, and savings. In one year savings of over $58,000 was shown by our engineers survey. Time has proved the correctness of this survey. Since the original order of 88 containers, so many more uses for the equipment and greater savings were discovered that 55 additional containers have been placed in service with a grand total of 143 containers now being handled by the four trucks.



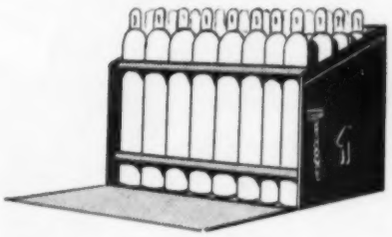
DROP BOTTOM CONTAINERS. 48 drop-bottom containers were furnished for handling trash and rubbish, steel turnings, scrap metal, tube ends and clay:—Twenty 6 cu. yd. open top type, one 6 cu. yd. with lids, nine 2½ cu. yd. open top type, two 2½ cu. yd. open top with casters, six 3 cu. yd. open top, nine 4 cu. yd. with lids, one 4 cu. yd. enclosed with hinged door in top.



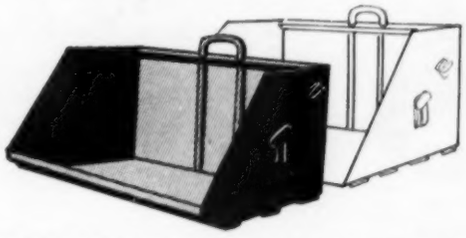
UNIVERSAL CONTAINERS. 13 universal containers were furnished for handling trash and rubbish. Universal containers feature completely enclosed construction, drop-bottom dumping, a door in either end for ground-level loading and a lid in the top for loading from a platform.



TILT TYPE CONTAINERS. 16 tilt type containers were furnished for handling general refuse, sludge and settlings:—Four 3 cu. yd. open top type, nine 3 cu. yd. with lids, three 3 cu. yd. with lids and casters.



SPECIAL CONTAINERS. 3 special containers were furnished for handling and transporting oxygen cylinders from one point to another in the refinery. This container is typical of the many highly specialized uses for which Dempster-Dumpster containers are constructed. Many other containers are available for handling almost any type of material known, be they liquid, dust, light or bulky or very heavy materials.



SKIP TYPE CONTAINERS. 7 skip type containers were furnished for handling refuse wax, oil, lube and coal:—Three 3 cu. yd. skip type with lid, three 3 cu. yd. skip type without lid, one 3 cu. yd. skip type with teeth.

DEMPSTER DUMPSTER
TRADE MARK REG.
SYSTEM

498 DEMPSTER BUILDING, KNOXVILLE 17, TENNESSEE

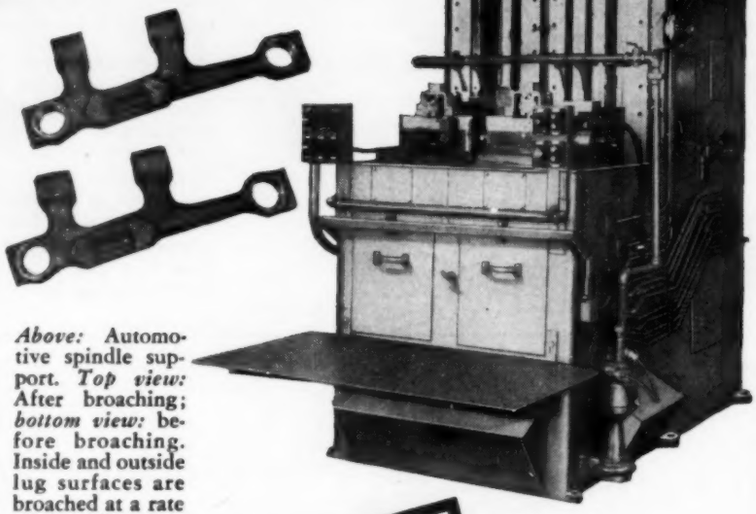
BETTER SURFACE BROACHING

BECAUSE *American* ANSWERS YOUR EVERY BROACHING NEED

You get better surface broaching when you deal with *American* because *American* is a single coordinated source for all your broaching needs. On this job, for example, *American* provided the user of large automotive spindle supports with: (1) the most economical type of broaching machine; (2) accurate and correctly designed broaches; (3) a rugged, heavy duty, yet fast loading, fixture with automatic clamping for high production broaching of these parts.

Just one source for the complete job!

For all your broaching needs—surface broaching, internal broaching, or external broaching—you will find it to your advantage to see *American* first. *American* answers your every broaching need—machines, tools, and engineering. Send us your specifications or write for further information.



Above: Automotive spindle support. *Top view:* After broaching; *bottom view:* before broaching. Inside and outside lug surfaces are broached at a rate of 240 pieces per hour net.

PART: Automotive spindle support.
OPERATION: Surface broach inside and outside lugs.
MACHINE: American Standard SBD-48-15.
MATERIAL: Steel forging.
STOCK REMOVAL: 3/16" stock per face.
TOOLING: Two single station fixtures provided for each ram.
FEATURE: Each fixture designed to accommodate either right or left-hand part.

Above. American SBD-48-15 Vertical Hydraulic Broaching Machine with dual hydraulic receding work tables and dual push button controls (a safety measure). Automatic jack supports are provided under the part lug to compensate for irregularity of part.

Left: Operator loads one part in right hand fixture and starts machine. Part is automatically clamped down as table moves into broaching position. While right hand ram starts down travel to broach part, operator loads left hand fixture, which is in out position. From this point on, operation is continuous. Operator unloads and re-loads one fixture during down travel of opposite ram.

New Circular on Surface Broaching Machines

A new 12-page circular gives details and specifications on *American* Vertical Hydraulic Surface Broaching Machines. A copy is yours for the asking. Write for Circular 300-S.

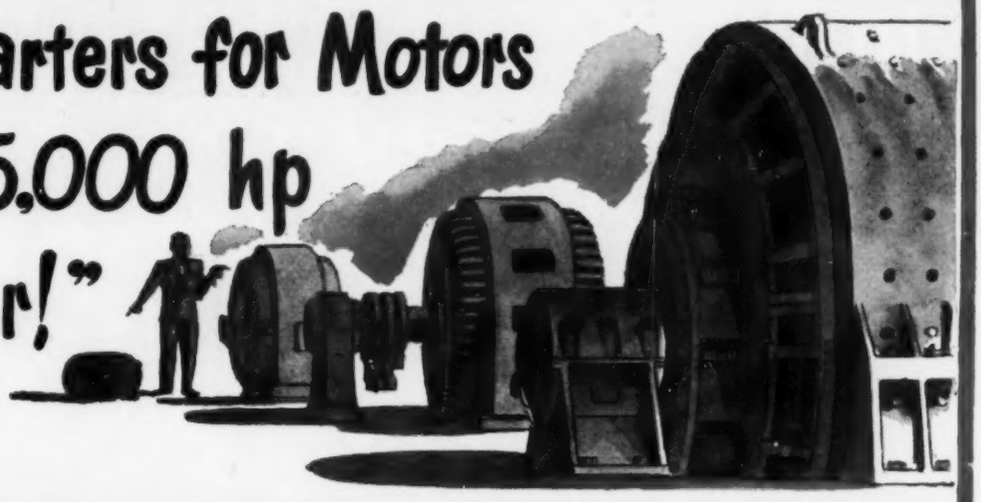
AMERICAN *American* BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

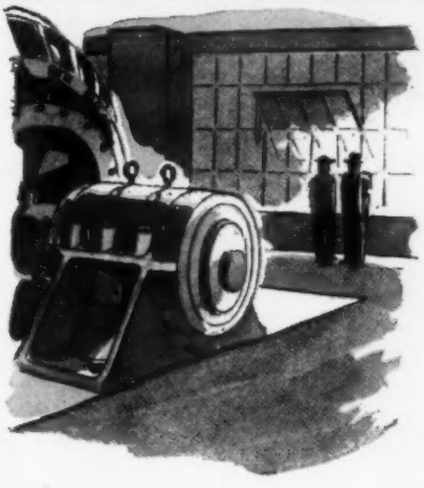
ANN ARBOR, MICHIGAN

See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

"Headquarters for Motors ½ to 25,000 hp and Over!"



Do You Need General-Purpose, squirrel-cage motors from 1 to 200 hp? Call either your nearby Allis-Chalmers *Authorized Dealer* or District Office. They may be able to help you from stock right now!



But For Large Ratings—250 to 25,000 hp and over—your Allis-Chalmers *field engineer* is the man to call. He can give you *expert* motor advice; help you solve difficult drive problems involving large or small motors. And he'll save you time and money.

Allis-Chalmers Motor-Building Capacity has been greatly increased. New methods, new equipment have been put to work to turn out *good* motors in greater numbers.

And Our Delivery Situation is improving! For *reliable* delivery information call any of over 60 District Offices or over 200 Allis-Chalmers Dealers. They have *up-to-the-minute* delivery information available to them!

Building Good Motors for Over 50 Years

THE *QUALITY* of Allis-Chalmers motors is best proven by their records of performance. Look back at your own experience, or ask your friends in industry who have "A-C" motors what they think of them. The answer is invariably the same . . . "They're *good* motors, liberally designed, easy to service, and run year-after-year with little attention."

Whether you're buying ½ hp motors to be designed into your product . . . or a 25,000 hp motor for a steel mill you can rely on the *good* quality of "A-C" motors! ALLIS-CHALMERS, MILWAUKEE.

A 2400

ALLIS-CHALMERS

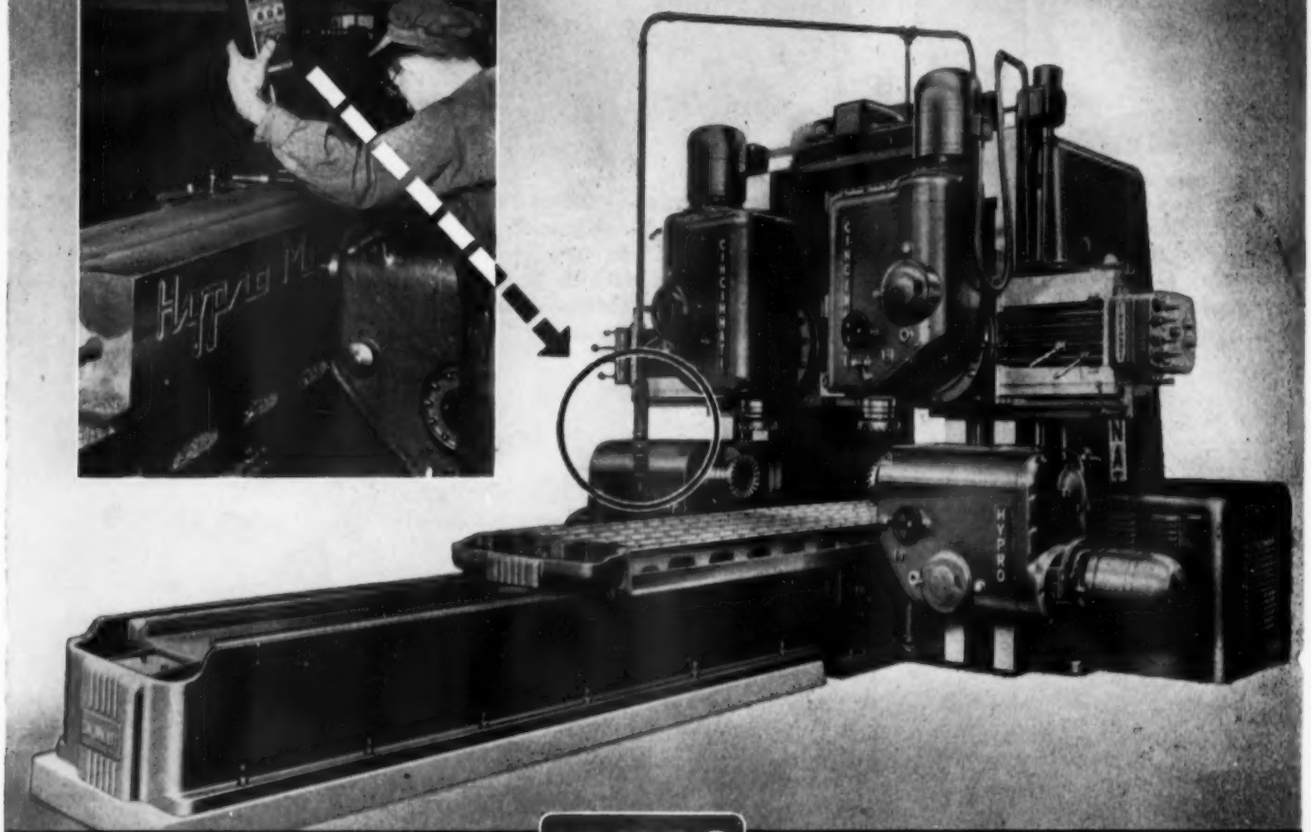
One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

NOW COMPLETE FINGER-TIP CONTROL FROM PENDANT STATION...

Hypro·electronic

PLANER MILLER DRIVE

Photo on left shows operator milling the words Hypro Miller in cast-iron block — an unusual demonstration of the versatility and absolute control of any head or table from pendant station exclusively.



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

This unique sheet-metal punch, made by Rotex Punch Company of Oakland, Calif., provides a compact arrangement of punches and dies which are housed in revolving turrets so that the operator can make a quick selection of the punch he wishes to use. It accommodates 17 different punches and a shear blade, all made of Bethlehem XX Carbon Tool Steel.

Long tool life and keen cutting edges are provided for in the handy Rotex punch by the use of Bethlehem XX Carbon Tool Steel for all punches, dies, punch holders, and shear blades. This is a typical use where the basic advantages of carbon tool steel make it a logical selection.

CARBON—THE GENERAL-PURPOSE GRADE

Our carbon tool steels are the best choices for a wide range of tools and dies. Here's why:

★ They are the easiest to machine of all tool steels.
★ They have a hard case and a tough core.
★ They develop keen cutting edges.
★ They are easy to heat-treat.

Bethlehem X Carbon Tool Steel (0.75 to 0.85 pct carbon) is recommended for hand chisels and shock tools. XCL, XX, and XXX grades have several ranges of carbon content: 0.90 to 1.00 for cold-heading die steels; 1.00 to 1.10 for most tool and die work; 1.15 to 1.25 where extra-keen cutting edges and greater wear-resistance are needed for stone-dressing tools, paper-knives, drawing dies, etc.

CLOSE CONTROL OF HARDENABILITY

Easy machining and uniform results in heat-treating carbon tool steel are made possible by our close control of hardenability in the steelmaking process and uniform spheroidize-annealing. Bethlehem's extensive research has established the ideal degree of hardenability for a wide range of applications.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corp.

Export Distributor:
Bethlehem Steel Export Corporation

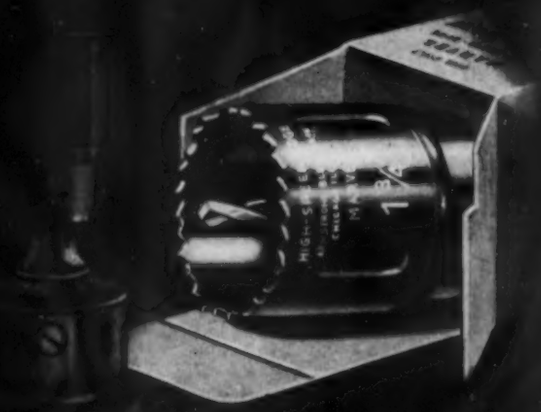
BETHLEHEM STEEL

CARBON . . . one of Bethlehem's Fine Tool Steels

Metal Cutting

MARVEL SAWS

Better Machines–Better Blades



Regardless what type hack saw machines and metal-cutting band saw machines you use, MARVEL BLADES will improve performance. There are sound reasons why this is true; practical reasons that are easily understood and demonstrated.

MARVEL High-Speed-Edge Hack Saw Blades, with a genuine high-speed-steel cutting edge integrally welded to a tough alloy steel body, are both fast-cutting and *positively unbreakable*. This construction permits greatly increased speeds and feeds and tauter blade tensioning. Still, they last much longer than ordinary blades.

MARVEL High-Speed-Edge Hole Saws, with this same unbreakable construction and heavy-duty arbors, have the extra strength required for drill press and lathe use . . . rapidly saw holes from ⅜" to 4½" diameter thru steel of up to 1⅛" thickness.

MARVEL Band Saws are of selected quality. They come ready for use, pre-welded to size for each make and model saw. Individually boxed, they are protected against kinking, rusting or damage to teeth!

Write for Blade Catalog Sheet.

ARMSTRONG-BLUM MFG. CO.

5700 BLOOMINGDALE AVE. • CHICAGO 39, U. S. A.

the Cone Reporter notes that—

Conomatic Progress Reporter

General Electric has a new thin asbestos paper for use as insulation in high temperature electric equipment.

Progress with Conomatics

Alabama Power Co. is conducting a second series of tests on the method of producing combustible gases from coal by burning it underground.

Conomatics for *Progress*

The 1" 6-Spindle Conomatic is the first multi-spindle automatic that provides change of tool slide working travel for *all* slides without cam change.

Progress with Conomatics

A new secret alloy for gun barrels is said to greatly increase the life of all sizes from 16-inch to machine guns.

Conomatics for *Progress*

An automatic counter made by Potter Instrument Co. of Flushing, N. Y., is said to count stacked sheets of paper as fast as 1,600,000 per second. The counter can also be used on other small parts.

A process for making cheap barium chloride is reported from the University Department of Chemical Technology of Bombay, India.

Progress with Conomatics

Industrial Research Institute of the University of Chattanooga claims to have produced a transparent plastic so hard that it is practically scratchproof.

Conomatics for *Progress*

Germ-free cement is being made by North American Cement Corp.

Progress with Conomatics

Tests made by Allen B. DuMont Laboratories indicate that television is not restricted to the line-of-sight but can be received up to 125 miles.

Conomatics for *Progress*

The Army Signal Corps has developed an electric battery that will function at 100 degrees Fahrenheit.

Dayton, Ohio, is planning railplane service to its municipal airport. This system of transportation uses a suspended car and has been tried in Europe for about ten years.

Progress with Conomatics

Goodrich has a new air hose that is claimed to be as light and flexible as a lamp cord.

Conomatics for *Progress*

A new mineral (zinc tungstate) has been discovered in Argentina and named Sanmartinite after a national hero.

Progress with Conomatics

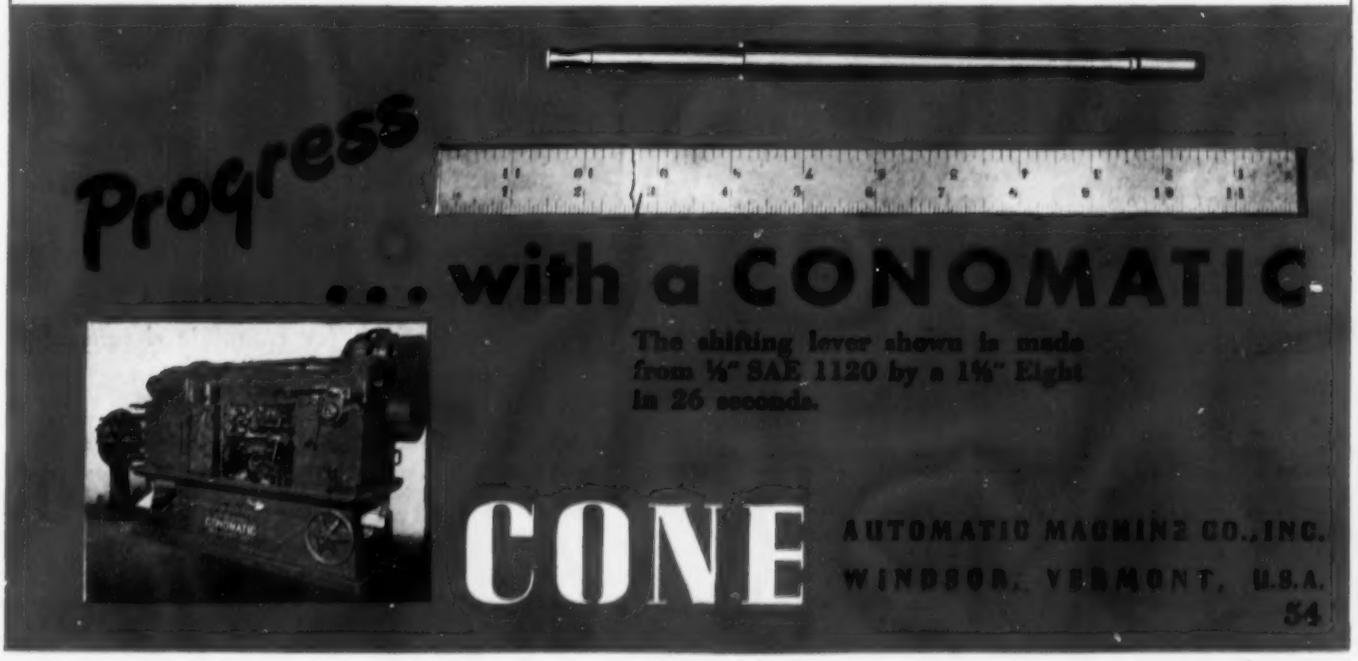
Patent No. 2,444,045 covers a method of safely removing high explosives from surplus shells in order to recover both the explosive and the steel.

Conomatics for *Progress*

A new weaving machine is under development by Warner & Swazey. It is claimed to produce cloth about 2½ times as fast as conventional machines.

Progress with Conomatics

Owens-Corning Fiberglas Corp. makes a transparent glass cloth for use in greenhouses in place of glass panes.


Progress
... with a CONOMATIC
The shifting lever shown is made from ⅛" SAE 1120 by a 1⅛" Eight in 26 seconds.
CONE
AUTOMATIC MACHINE CO., INC.
WINDSOR, VERMONT, U.S.A.
54

Little Refinements in design of

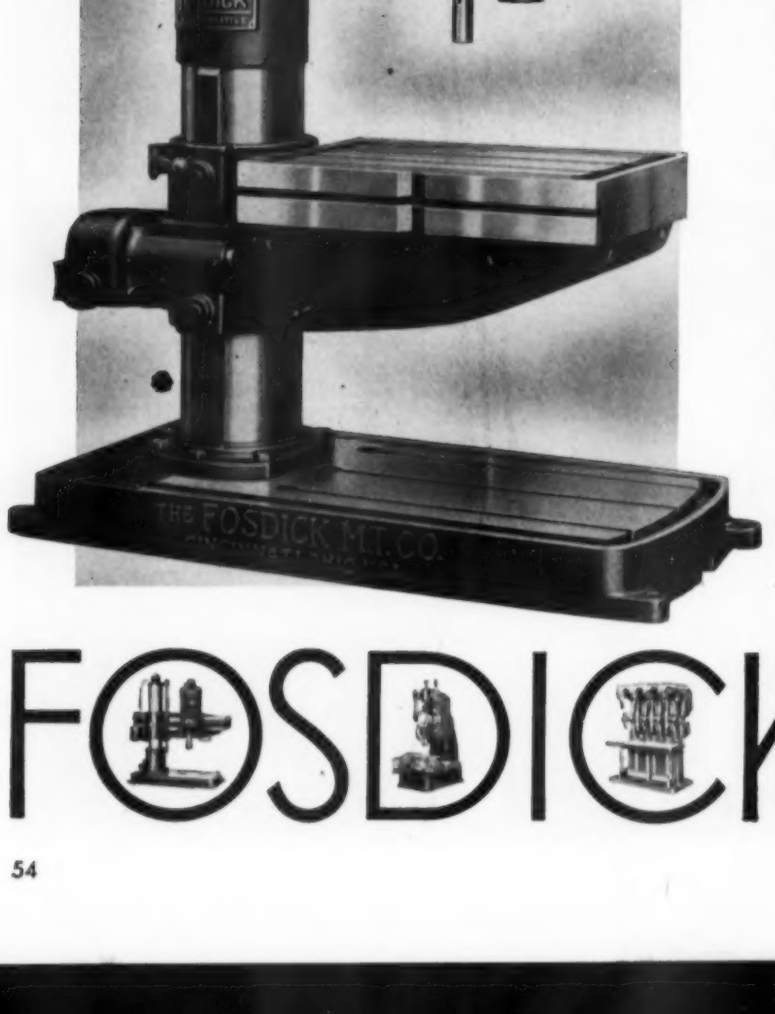
FOSDICK *SENSITIVE* RADIAL

Pay off in...

EASIER OPERATION

GREATER PRODUCTION

LOWER COSTS



All control levers are conveniently located—the speed shift lever is at the lower left side of the head—speed indicator dial is direct reading and self explanatory—the start, stop and reverse lever is at the lower right side of the head—the feed change lever is at the upper right side of the head—the head clamp lever is on the left side of the head —and the arm clamp lever is on the front of the arm barrel. This centralization of controls enables operator to make all necessary adjustments and operate the machine from his normal working position easily and quickly.

Thus ease of operation plus adaptability of radial design enables you to increase production and cut costs on a wide range of sensitive drill work requiring holes up to 1½" diameter.

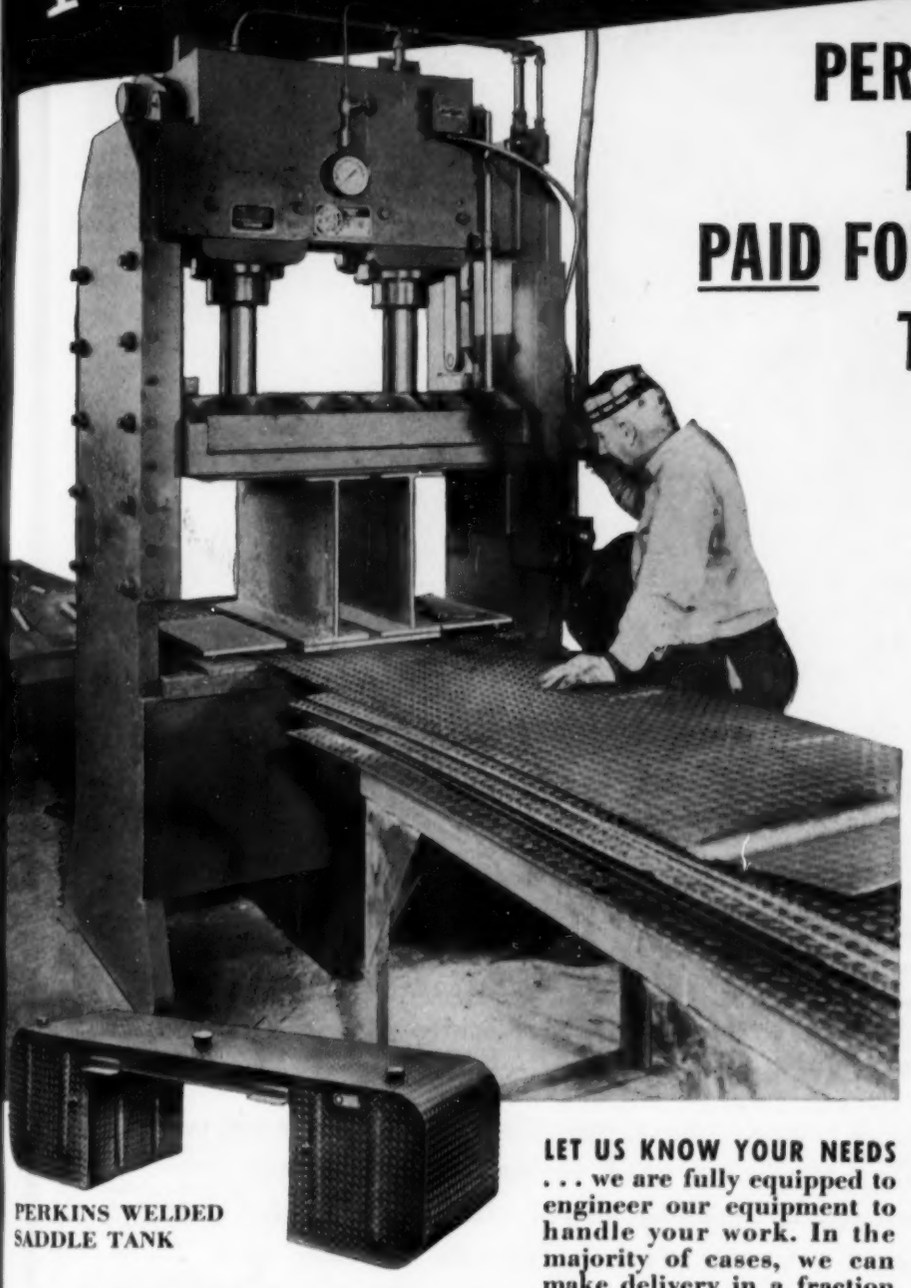
The raising and lowering table which swings in an arc of 360°—the arm at fixed height, which also swings in an arc of 360°—and the one piece column construction are distinctly new design features that make this original Sensitive Radial not only desirable but a most practical unit for handling a wide range of sensitive drilling.

Write for the Fosdick Sensitive Radial Bulletin R. S. A. for complete details of construction and operation.

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO

"I wouldn't sell it for Twice what it Cost"

PERKINS WELDING SAYS KRW 100-TON PRESS PAID FOR ITSELF IN 60 DAYS THRU MATERIAL AND LABOR SAVINGS!



PERKINS WELDED SADDLE TANK

BIG TRAILER TRUCKS eat up a lot of gas on an average run. For that reason, most are equipped with big "saddle tanks" which hold 125 gallons or more... thus obviating frequent stops to fuel up. Perkins Welding makes these super tanks out of 1/8 inch steel. Until recently, they welded angle stiffeners onto the tanks for extra strength. A KRW Engineer showed them how they could save considerably by forming stiffening ribs on a KRW 100-Ton Press. The result... savings so great that "it paid for itself in 60 days."

"You don't need a sledge to drive a tack". For the same reason... on a big percentage of forming, blanking and stamping work ... you don't need large, heavy-tonnage presses with their high initial and operating costs.

Production records, in a variety of industries, show that KRW Presses greatly reduce costs. First investment is very low, operating costs are still lower. In one instance the purchase price of a KRW Stamping Press was less than the foundation cost for heavier equipment.

KRW Presses are highly flexible... they can be built with platen sizes up to 36" x 60", and can be gap, open or closed end in type. Tonnage pressures can vary from 25 to 100-tons. Because they are hydraulically operated and not mechanically driven, they are quiet and vibrationless in operation. They are equipped with automatic safety and operational controls. Platens can be stopped at any point in their travel.

LET US KNOW YOUR NEEDS ... we are fully equipped to engineer our equipment to handle your work. In the majority of cases, we can make delivery in a fraction of the time required for other type presses. Let us hear from you.

ALL TYPES OF DIES. We are equipped to engineer and build dies to meet your specifications. All we need is available technical data, blue prints and, where practical, a sample piece of work. We'll quote prices and delivery date.

THE STANDARD KRW 100-TON HYDRAULIC PRESS IS ONLY $4850 FOB*

NAME YOUR NEEDS... MAIL COUPON TODAY

**Prices subject to change without notice.*

K·R·WILSON

115 MAIN ST. · BUFFALO 3, N. Y.

K. R. WILSON, 215 Main St., Buffalo 3, N. Y. 11

Please quote me prices and information on following type KRW Presses. Please check. Gap ☐ Open End ☐ Closed End ☐

Tonnage Req..... Die Dimensions.....

Name.....

Address.....

City and Zone..... State.....

Offset Your High Labor Costs with Gardner DOUBLE Grinding!

WORK DATA	
Part	Gear Blanks
Material	Cast Iron
Operation	Grind Two Parallel Sides
Tolerances	.001" to .002" Parallel .002" to .003" Uniform
Stock Removal	Roughing - .030" to .040"; Finishing - .010" to .020" Maximum Overall
Production	Roughing - 6 to 8 Pieces per minute; Finishing - 8 to 10 pieces per minute
Feed	Hand Load Ejector Unloading
Machine	No. 125-26" Gardner Double Grinder

SEMI-AUTOMATIC in operation, GARDNER *Double* GRINDERS cut down labor costs on many kinds of parallel-surface parts by precision-grinding TWO sides with ONE pass through the machine.

In the example above, gear blanks are hand loaded into a rotary attachment, which carries them between two opposed 26" grinding wheels. They are unloaded by an automatic ejector. Two cuts or passes are required.

Use Modern GARDNER WIRE-LOKT Abrasives on YOUR Disc Grinders!

For information that will help you to offset your high labor costs, and speed up your parallel-surfacing operations —

Write for GARDNER *Double* GRINDING Bulletin!

GARDNER - GRIND YOUR *Flat* SURFACES

GARDNER MACHINE COMPANY

410 East Gardner Street . . . . Beloit, Wisconsin, U.S.A.

NEW SIMOMETER

gives you accurate **TESTED TENSION** in less than 1 minute per blade

Here's how SIMONDS Quick and Easy Tensioning Method gives you LONGER BLADE LIFE!

Avoid Undertension which causes crooked cutting, spoiled work, lost time.

Avoid Overtension which causes blade-vibration, rapid dulling of teeth, frequent blade-breakage.

Slip the *Simometer* Directly over Blade, tighten two thumb-screws . . . now put tension on blade until **Simometer** needle moves into green zone . . . and you *can see at a glance* you have the right tension on the blade.

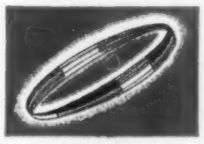
Then You're Set to get Faster, Straighter Cuts... and more cuts per blade... *the full measure* of performance which **SIMONDS** "Red End" Power Blades are made to give you. Ask your distributor.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 51 W. Trent Ave., Spokane 8, Washington. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

SIMONDS ALSO MAKES:

FLAT GROUND STEEL STOCK (Oil Hardening)

"RED TANG" FILES


METAL-CUTTING BAND SAWS (Regular Hard Edge, Skip-Tooth, Spring Temper)

CIRCULAR METAL-CUTTING SAWS (Inserted-Tooth, Segmental, Solid-Tooth)

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.
Other Divisions of SIMONDS SAW AND STEEL CO., making Quality Products for Industry

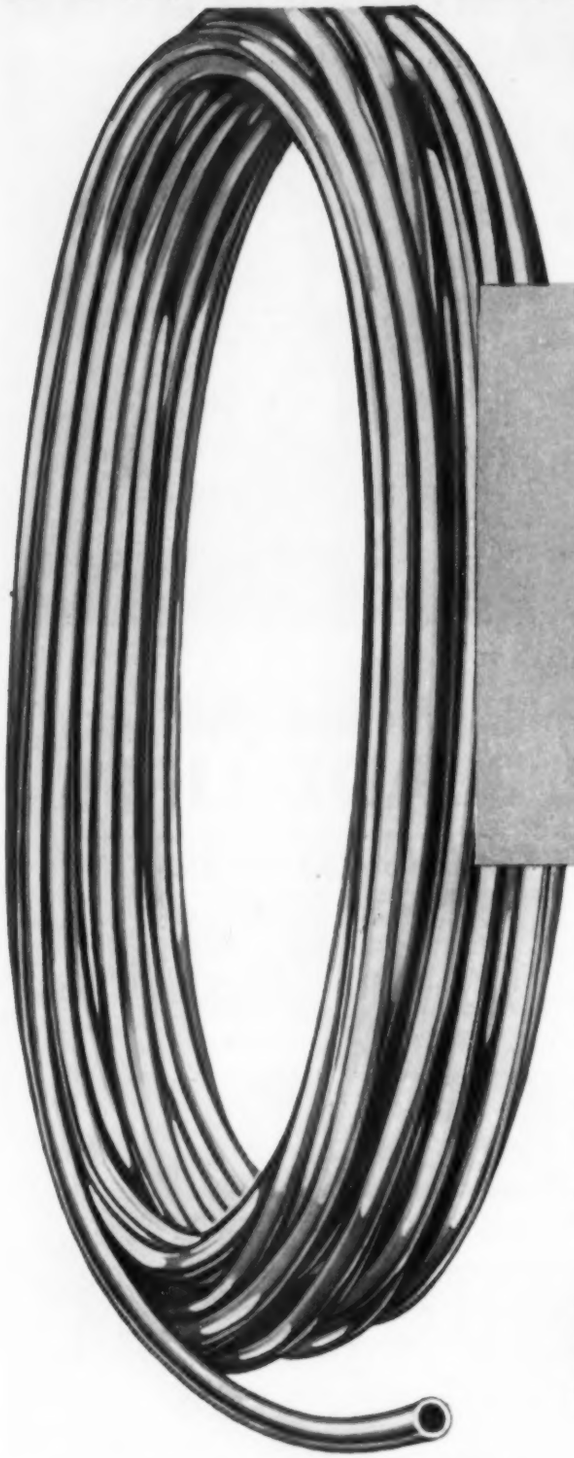
SIMONDS — Special Electric Furnace Steels
SIMONDS — Grinding Wheels and Grains
SIMONDS — Simonds Products for Canada

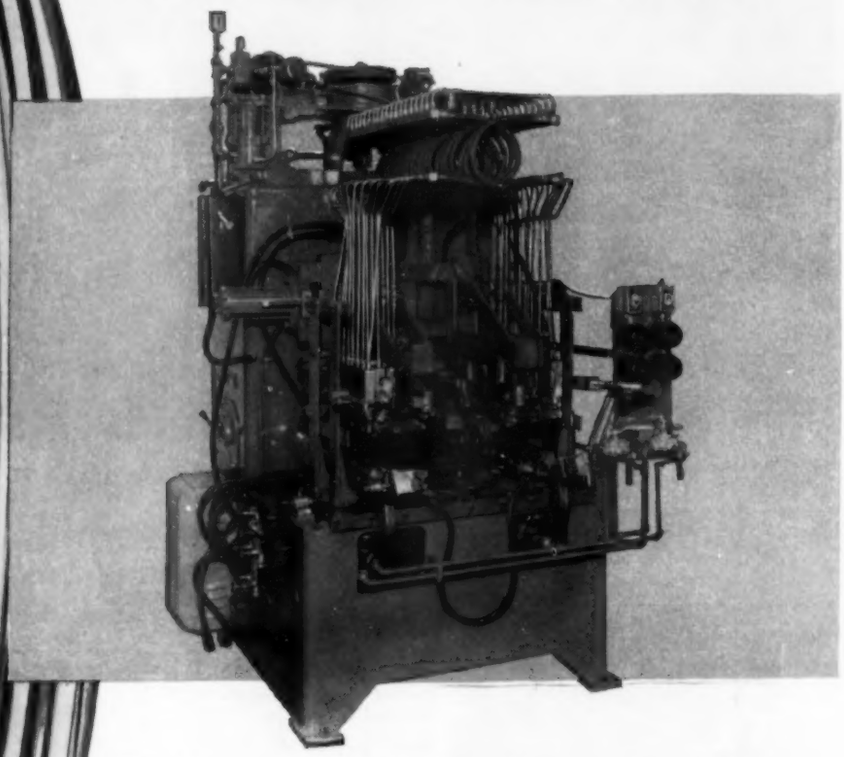
SIMONDS "Red End" HACKSAW BLADES

WHEN YOU USE SIMONDS YOU STAY IN THE HIGHLANDS . . . OF CONSISTENT CUTTING EFFICIENCY

ECONOMICAL TUBING

FOR SPOT WELDER COOLING SYSTEMS





For this use, or for hydraulic and pneumatic controls, oil, gas, and refrigerant lines, Alcoa Aluminum Tubing costs less.

Alcoa Aluminum Tubing is light, yet strong to withstand hard service. It's easy to form and flare. It's resistant to corrosion by most liquids, gases, and refrigerants. Cannot cause oil sludge.

Alcoa Aluminum Tubing is made in a wide range of diameters and wall thicknesses, and in special alloys to withstand high-vibration service.

For information about the availability of Alcoa Aluminum Tubing, its economic advantages, and applications in your industry, call your nearby Alcoa Sales Office, or write to ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.
Sales offices in 55 leading cities.

ALCOA

ALCOA *Aluminum* TUBING®

6 Parts on 1 Machine

BARNESDRIL Special Unit-Type Machine

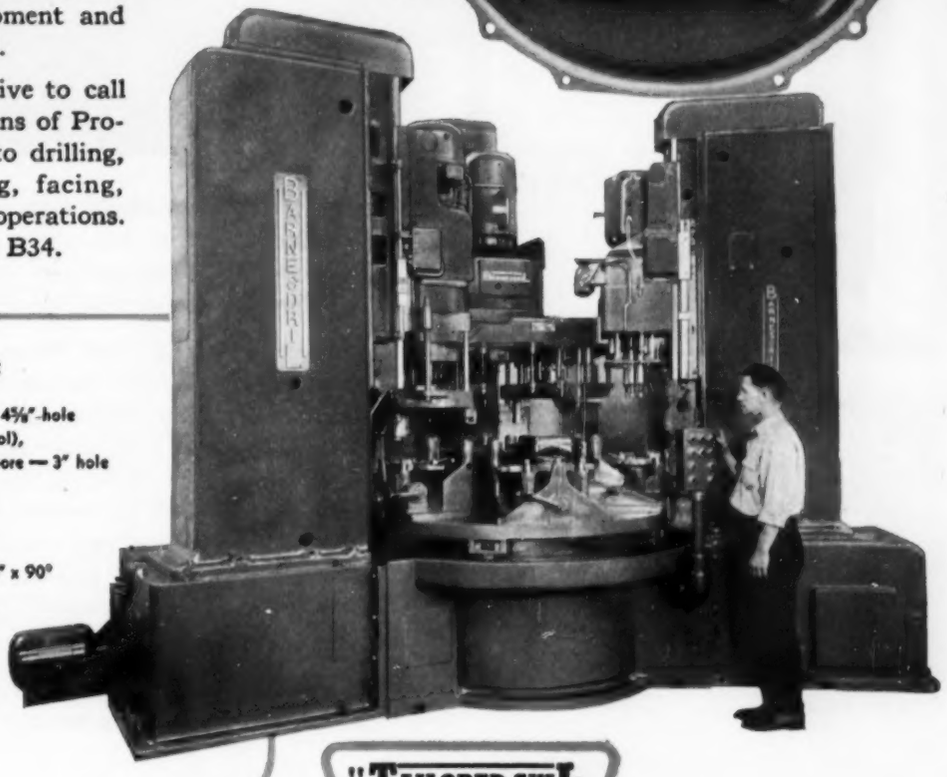
INTERCHANGES TOOLS AND FIXTURE PLATES TO MACHINE 6 SEPARATE HOUSINGS

Less floor space and equipment, more pieces per hour, and greatly reduced production costs are realized on this BARNESDRIL Production Unit-Type Machine.

Six separate transmission housings are processed on this one BARNESDRIL machine by interchanging tools and fixture plates. Five-station automatic index table provides continuous machining while loading and unloading are taking place. Output is 75 pieces per part per hour at 85% efficiency.

As a result of combining thirteen operations in one automatic cycle, idle machine time and individual work handling have been eliminated, and required investment in equipment and floor space have been reduced.

Ask a BARNESDRIL representative to call and explain further applications of Production Unit-Type methods to drilling, reaming, tapping, threading, facing, counterboring and milling operations. Send for Bulletins B1504 and B34.



OPERATIONS:

1st STATION — Rough, semi-finish bore — 4⅝"-hole
— Back chamfer (feed-out tool),
— Rough, semi-, and finish bore — 3" hole

2nd STATION — Drill 4 holes — 25/64"
— Drill 2 holes — 23/64"
— Drill 2 holes — 19/64"
— Countersink 4 holes — .44" x 90°

3rd STATION — Finish bore hole — 4.69"
— Ream 2 holes — .1377"
— Ream 2 holes — .315"

4th STATION — Tap 4 holes 7/16" — 20

5th STATION — Load and Unload

"TAILORED-SKIL by BARNESDRIL"

BARNES DRILL CO.

830 CHESTNUT STREET ROCKFORD, ILLINOIS U.S.A.

THE NEW Van Keuren

0 to 3" LIGHT WAVE MICROMETER

will improve your product . . .

Hardened, Ground, and Lapped ½" diameter Micrometer Screw. Reads to .00001" Carboloy tipped spindle and anvil.

The
LIGHT WAVE MICROMETER HEAD

A source of dependable Precision for modern machine tool and instrument applications.

•

Price, with calibration chart $75.00

The new 1948 VK Catalog and Handbook No. 34, is a 208 page manual indispensable for engineers, designers, inspectors, toolmakers and machinists. It contains simplified formulas and accurate tables for measuring spur gears, helical gears, splines and worms. New and epoch making formulas and tables are presented for the first time for the exact measurement of 29, 40 and 60 single and multiple start screw threads and worms. It includes a complete resume of American & European screw thread systems, new methods of measuring included angle of screw threads, a new method of inspecting flat ring seal surfaces with light waves, and other valuable information. Price $1.00 each postpaid.

THE Van Keuren Light Wave Micrometer is an instrument of exceptional merit, proven over a period of 15 years. It has enabled hundreds of High School boys and girls to produce and inspect parts to "Hundred Thousandths" of an inch.

The New 0 to 3" Light Wave Micrometer has a ½" diameter, 40 threads per inch micrometer screw, which can be made with greater accuracy and which has 3 times the wearing surface of an ordinary micrometer screw. It has an 8" diameter micrometer wheel, with .0001" graduations 1/10" apart. It has a non parallax, vernier index which enables readings to be made to .00001". It has an index lock. It has carboloy tipped anvil and spindle. It is a sturdy, yet sensitive instrument which weighs 17 pounds. It is a portable measuring machine, built for "Sustained Accuracy".

The Light Wave Micrometer is not a comparator. No gage blocks are needed and no errors creep in from worn blocks. It is a direct source of dependable precision—fast, accurate and profitable.

THE Van Keuren CO., 176 WALTHAM STREET, WATERTOWN, MASS.

29th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

At The R. K. LeBlond Machine Tool Company, Model A Cleveland automatics are turning out a wide variety of production parts for the complete line of LeBlond Lathes. Savings in part costs and man hours are illustrated by the typical job shown above.

Cleveland Model A's are versatile in their wide application to diversified work. Ease of tooling up and accessibility for adjustments make set-up time short—make large and small quantity production equally profitable. Flexibility of automatic controls provides for accurate pre-selection of the correct feed for each multiple operation—all the way from broad forming cuts to fast, light finishing.

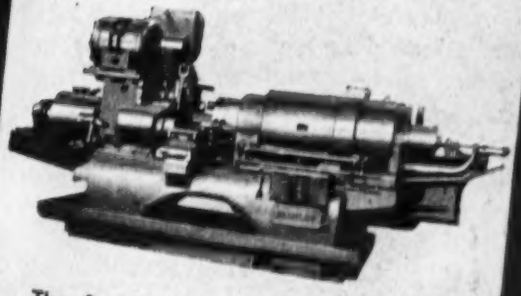
On the 3¾" and 5¾" Model A Clevelands, both speed of set-up and flexibility of control have been further advanced by *electric feed drive* for turret tools. Turret feeds are simply set by dials on the control panel.

Have you investigated the *profit possibilities* of applying Cleveland Model A's to your production? Ask Camco engineers to submit a direct proposal with production estimates on your work. Write now for details and bulletins giving complete machine specifications.

Remember *Clevelands Cut Costs—*

CLUSTER GEAR BLANKS FORMED COMPLETE ON CLEVELAND 5¾" MODEL A

Seven diameters on this SAE 4140, 5" x 5½" gear blank for the headstock of a LeBlond Regal Lathe are formed complete with one form tool in a 5¾" Model A Cleveland. Turret operations include drilling and reaming full length.



The forming job illustrated above is produced on this 5¾" Model A Cleveland, equipped with electric turret tool feed drive. Cleveland Model A's are made in seven sizes ranging from 1 1/16" to 9½" capacity.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4928 BEECH STREET • • CINCINNATI 12, OHIO

CHICAGO (6) 3710 Civic Opera Bldg. CLEVELAND (14) 1114 NBC Bldg. DETROIT (2) 540 New Center Bldg.
HARTFORD (1) 529 Capital National Bank Bldg. NEW YORK (6) 2402 Singer Bldg.

COMMON SENSE ASSEMBLY ENGINEERING

"Polishes off" parts spoilage

CURES A TAPPING HEADACHE . . .

The Regina Corp., manufacturer of this versatile electric floor polisher, says, "Tap breakage in blind holes often resulted in the loss of expensive castings. Parker-Kalon Self-tapping Screws were found to be the perfect answer to the problem. Assembly costs took an appreciable drop as soon as we changed over!"

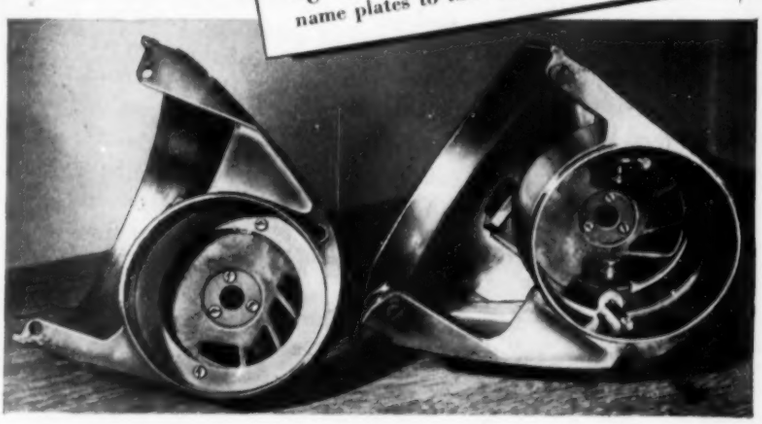
Because P-K Self-tapping Screws form their own threads as they are driven, they eliminate the need for troublesome tapping . . . make possible faster, lower-cost assemblies. They provide strength where it is needed, are easily removed and replaced for repair purposes.

Common sense engineering may be the "perfect answer" to assembly problems in your plant. In 7 out of every 10 cases, the use of P-K Screws permits savings up to 50% in work hours by skipping unnecessary tapping, nut running, riveting, or mold-slowing inserts in plastic. And in many products they add extra strength, simplify design.

Try the P-K fastening method . . . it's simpler! Ask a P-K Assembly Engineer to examine your assembly to see if it's one of the "lucky seven." Or, mail assembly details for recommendations. Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

Sold Only Through Accredited Distributors

• In this Regina Electric Floor Polisher, three P-K Type "F" Screws are used to fasten an armature gland washer to each side of the ANACONDA zinc-base die cast housing. Two P-K Type "F" Binding Head Screws fasten the ventilating baffle ring to the small end of the housing. Six P-K Type "U" Drive Screws fasten the data and name plates to the completed unit.



P-K® The Original

A TYPE AND SIZE FOR EVERY METAL AND PLASTIC ASSEMBLY

PARKER-KALON SELF-TAPPING SCREWS

PARKER-KALON PRODUCTS COLD-FORGED SOCKET SCREWS, WING NUTS, THUMB SCREWS • HARDENED SCREWNAILS AND MASONRY NAILS SHUR-GRIP FILE AND SOLDER IRON HANDLES • METAL PUNCHES • DAMPER REGULATORS AND ACCESSORIES

VULCAN TOOLS
HELP
MAKE THEM

SPECIAL TOOLS SLASH THE COST OF *YOUR* PRODUCTS

In your tooling program for the "better things for better living" which you make, Vulcan Tool Company, which is splendidly equipped with every machine tool a contract shop should have, (and some tools of its own design for special purposes) will help you in designing and building. It has helped many others since 1915.

Let's talk about special tools and machines for speeding up your production. For better acquaintance ask for Vulcan Equipment List.

VULCAN TOOL CO.

DAYTON 10, OHIO, U.S.A.

Complete Tooling Programs

all welded construction . . .

NO WEAK OR WABBLY JOINTS

Fig. 732
Pat. & Pats. Pending
Drawer is extra
"Hallowell" Work Bench
of Steel

Fig. 210 RHB
"Hallowell" Steel Stool
(adjustable)

HALLOWELL

SHOP EQUIPMENT OF STEEL

The *ready-made*, smooth-top, wear-proof "Hallowell" Work Bench, as shown, is the *ideal* modern addition to *your* shop. "Hallowell" Benches are also available with laminated wood tops; or steel tops covered with "Tempered Presdwood." The "Hallowell" is made in standard heights, widths and lengths . . . does not require costly bolting to the floor, and while usually arranged as individual units, these can *easily* be re-arranged and joined to form a continuous work bench of most any length . . . so *different* from nailed-together wooden benches!

"Hallowell" Chairs and Stools of Steel are made in a wide variety of styles and types to meet your every "seating" requirement . . . and designed for comfort while working. They are of sturdy, welded, and therefore, wabbleproof construction . . . available in fixed or adjustable heights . . . with or without backrests and foot rests . . . and in a full range of heights.

For complete information on these and other "Hallowell" Products, ask for the "Hallowell" Shop Equipment Catalog.

Write us for the name and address of your nearest "Hallowell" Industrial Distributor.

Fig. 200 MHB
"Hallowell" Steel Chair

OVER 45 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 4

BRANCHES: CHICAGO DETROIT INDIANAPOLIS ST. LOUIS SAN FRANCISCO

WHEN YOU WANT *More* TOOL LIFE

TRY BARBER-COLMAN CARBIDE TIPPED MILLING CUTTERS

This job was slow and costly because of low tool life and high cutter breakage. Three intermittent bosses on cast-iron brackets required the removal of ¼" stock. Hard spots and abrasive action of the material combined to shorten tool life by nicking and chipping the cutting edges.

After careful analysis of all factors, Barber-Colman Cutter Engineers recommended the use of carbide tipped shell end mills, with fewer teeth and slight-spiral gashes. Today, experience-tested B-C tip mountings and heat-treated high speed steel bodies are successfully withstanding the shock of the hard spots, and tool life and production are increased approximately 400%.

If your job conditions are suited to the use of carbides, consult a Barber-Colman representative on your next production problem. Experience the satisfaction that this manufacturer had in improving operation and increasing production.

Barber-Colman Company

GENERAL OFFICES AND PLANT 116 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.

JOB FACTS

Operation — Face mill 3 bosses removing ¼" stock, center boss 2" x 1", end bosses 2" x 2½".

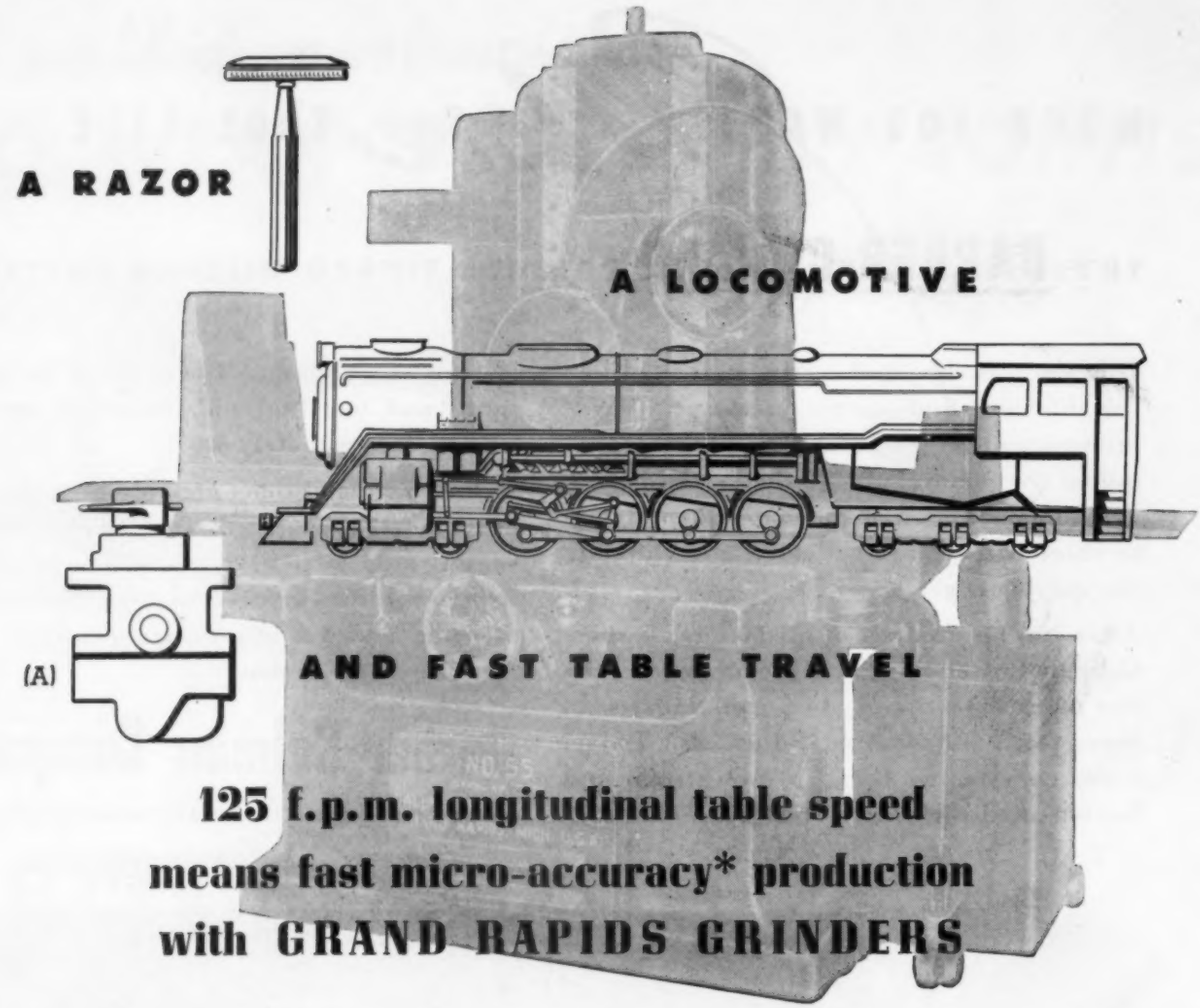
Material — Medium cast-iron.

Cutters — B-C Carbide Tipped Shell End Mills, 2¼" x 1½" x 1¼", slight spiral gashes.

	HSS Cutter	C-T Cutter
Feed	3"-4" per min.	15" per min.
Speed	40 S.F.M.	240 S.F.M.
Floor-to-floor	30-40 in 10 hrs.	90 in 10 hrs.
Tool Life	50 pcs. per sharpening.	200 pcs. per sharpening.

BARBER COLMAN

MODERN MACHINES DEMAND *Modern* CUTTING TOOLS



125 f.p.m. longitudinal table speed means fast micro-accuracy* production with GRAND RAPIDS GRINDERS

Fast longitudinal table travel — *the fastest available in any grinder* — is an important reason why you find Grand Rapids Grinders in so many leading plants. Such rapid operation makes possible high-speed, accurate production . . . of small mass-produced razor parts, as well as massive locomotive sub-assemblies. This high-speed table travel is achieved by a specially designed control valve (A) and vane type hydraulic pump. The special control valve changes the flow direction of the hydraulic fluid to rapidly reverse the table travel. The pump is operated by a separate motor, which is entirely independent of the spindle drive. And you get these other assurances of long-life speed and accuracy in Grand Rapids Grinders: vibrationless rigidity achieved by massive one-piece column and base casting; patented vertical head adjustment; flanged-type, preloaded ball bearing spindle; powered vertical travel of wheel head; and Bijur, one-shot lubricating system.

*Accuracy within 0.00025 limits

TO SERVE YOU — *Your inquiry concerning your specific grinding needs will receive prompt attention. Grand Rapids Grinders include: Hydraulic Feed Surface Grinders, Universal Cutter Grinders, Hand Feed Surface Grinders, and Combination Tap and Drill Grinders.*

GALLMEYER & LIVINGSTON COMPANY

305 Straight Ave., S. W., Grand Rapids 4, Mich.

GRAND RAPIDS GRINDERS

ELECTRONIC HEATERS ON THE JOB: HARDENING PINIONS

saving per pinion: $.25
production boost: 1500%
better product: no warpage

BIG DIVIDENDS are being realized with a G-E 20-kw electronic induction heater at the Ajax Flexible Coupling Company, Westfield, N. Y.

With one G-E electronic heater, this company now hardens the pinion cut on a shaft in a single operation. Formerly, two salt baths, quench tank, and a stress-relieving oil bath were required. Time - consuming handling operations have been eliminated; expensive machining operations have been reduced. Working conditions have been greatly improved.

What was formerly a half-month's production is now accomplished in *one* day with the G-E electronic heater. Cost savings of $.25 per pinion have been realized.

Also, the G-E electronic heater has greatly improved the quality of pinion shafts manufactured by this company. Shaft warpage has been completely eliminated. Gear-tooth distortion has been minimized, making a much quieter running gear.

Net result: more and better products at lower cost with induction heat.

Electronic
INDUCTION HEATERS

YOUR PRODUCT AND INDUCTION HEATING

Whether your product involves brazing, soldering, hardening, or annealing, be sure to get in touch with the Heating Specialist in the nearest G-E Office. His suggestions are very likely to result in higher production, lower cost, and better products, as they have for many other manufacturers. In the meantime, send for free bulletin GES-3290, "The How and What of Electronic Induction Heating." ***Sect. 675-179, Apparatus Department, General Electric Company, Schenectady 5, N.Y.***

GENERAL ELECTRIC

675-179

ARMSTRONG

ARMSTRONG TOOL HOLDERS

answer both . . .

1. **The problem of lowering costs**
2. **The problem of increasing output**

By providing permanent, multi-purpose, inexpensive ARMSTRONG TOOL Holders that use cutters or bits that are quickly ground from standard high speed shapes (Saving: All Forging, 70% Grinding and 90% High Speed Steel), the Armstrong System of Tool Holders will reduce your tool cost to an absolute minimum.

By providing stronger, more efficient tools, carefully developed for each operation, as well as ARMSTRONG High Speed Steel, ARMALOY Cast Alloy Cutter Bits or Armide Carbide-Tipped Cutters as required for each job, ARMSTRONG TOOL HOLDERS permit greatly increased speeds and feeds, enable you to increase the hourly output of every lathe, planer, slotter, shaper, turret lathe and screw machine.

There is no surer way to lower costs and increase output, than to use the correct ARMSTRONG TOOL HOLDER for each operation on all machines.

Stocked by Leading Tool Departments

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

5215 W. Armstrong Ave. Chicago 30, U.S.A.

New York and San Francisco

NEW ADDITIONS

PERMANENT MAGNET CHUCKS

NOW...NEW SMALL SIZES—NEW FEATURES

These new models have all the advantages of other B & S Permanent Magnet Chucks... ready portability, absence of wires and auxiliary generators, freedom from heating with attendant distortion of work, strong holding power—retained indefinitely. All, suitable for wet and dry grinding. For sale only in the United States of America and its Territories. For complete information write:
Brown & Sharpe Mfg. Co.,
Providence 1, R. I., U. S. A.

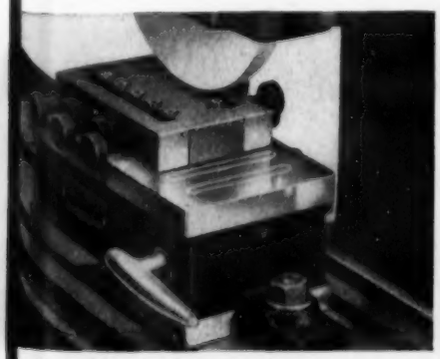
No. 408 Rectangular Model, with its small working surface (4" x 8"), is specially suited for use on small surface grinding machines, bench grinders and for bench work. Pole spacers are closer than on other rectangular models to permit holding smaller pieces.

No. 412 Two-Line Rectangular Model, has working surface, 4" x 12" and two line pole spacers. Useful for grinding rows of small parts as well as intermediate and large sizes. Many types of work may be laid end-to-end over line spacers. Packing strips not required.

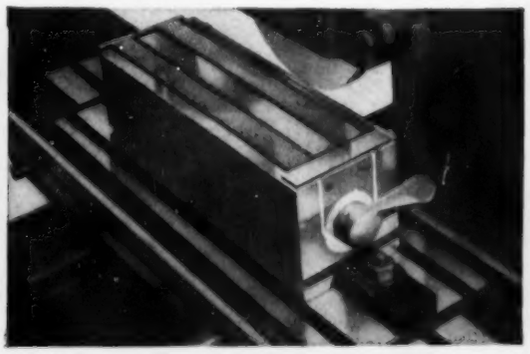
No. 5R Rotary Model, is the smallest B & S rotary model. Holds work from ¾" to 5" in diam. Control ring permits control of holding strength from any position in which chuck stops.

No. 7R Rotary Model, next smallest rotary model, holds work from $1\frac{3}{16}$" to 7" in diam. The amount of energy or holding power in the face can be controlled by giving the operating handle a part turn, thus permitting work to be moved or tapped into position and centered accurately.

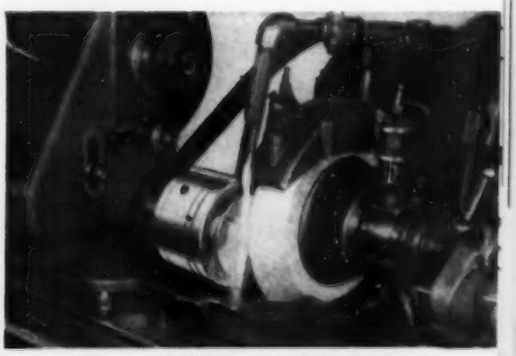
We urge buying through the Distributor



Grinding bushing ends on No. 408 Chuck



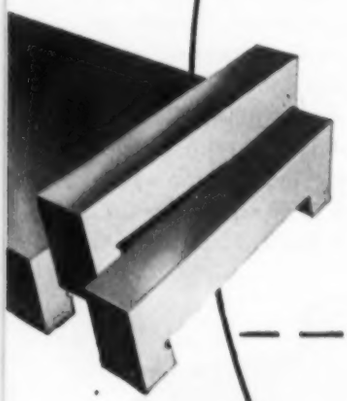
Group grinding on No. 412 Chuck



Disc grinding of pump part on No. 5R Chuck

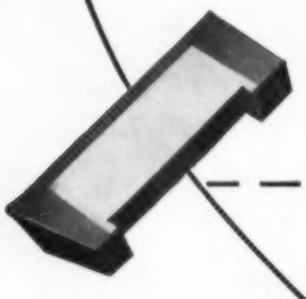
BROWN & SHARPE BS

How Hard are GISHOLT'S Hardened Ways?



to show you . . .

We took a section from the bedways.



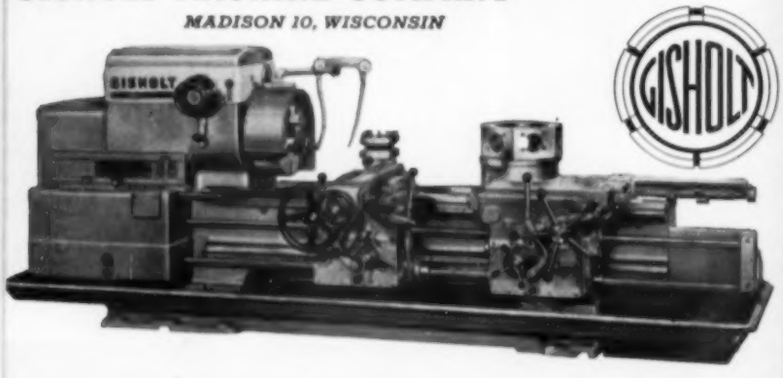
made it into a tool bit . . .

and cut metal with it!

Here it is, turning a shaft of 1045 cold rolled steel. This illustrates how precision is "hardened" into Gisholt Turret Lathes with all working surfaces hardened to 64-66 Rockwell C on ways, gibs and clamps. This extreme hardness makes Gisholt ways practically wearproof—insures lifelong accuracy—the kind of accuracy you want specified in your next turret lathe.

GISHOLT MACHINE COMPANY

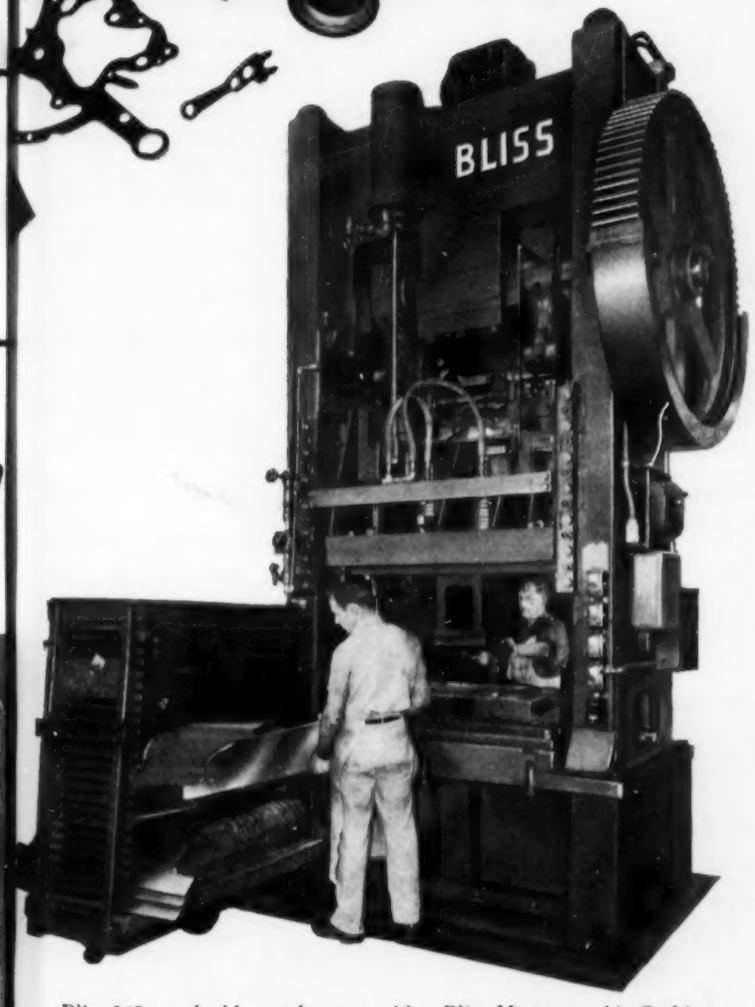
MADISON 10, WISCONSIN



URRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS
BALANCERS • SPECIAL MACHINES

A four-drawer, Class 6000 N-C-R Cash Register surrounded by some of the many stampings for this and other models.

How 230 Bliss Presses keep busy at National Cash Register



Bliss 165-ton double crank press, with a Bliss-Marquette Air Cushion with locking device in the bed, is used to form cash register cabinets. Marquette Cushions are also installed on the slide for knockout work.

Short production runs on literally thousands of different sizes and shapes of parts mean frequent die change-over at National Cash Register Company's Dayton plant. Here's where press flexibility, ease of set-up and uniform production are "musts."

That's why 230 Bliss presses, large and small, are kept busy from one end of N-C-R's production line to the other, blanking, drawing and forming the wide variety of stampings that go into cash registers, adding and accounting machines.

"We've had sustained performance with little 'downtime' over several decades of operation with Bliss presses," says National's press superintendent. "And Bliss has worked with us in providing special engineering to solve our stamping problems. We like the safety features built into Bliss presses, too."

This is another case example of why Bliss presses—mechanical or hydraulic—are preferred throughout the pressed-metal industry. Besides pioneering in press improvements and design, Bliss offers you a fund of engineering knowledge—going back over 90 years, all adding up to the fact that "Bliss" on your press is more than a name—it's a guarantee.

To get the most out of press production, discuss your problems with a Bliss engineer. Send for him today.

E. W. BLISS COMPANY, DETROIT 2, MICHIGAN

Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery

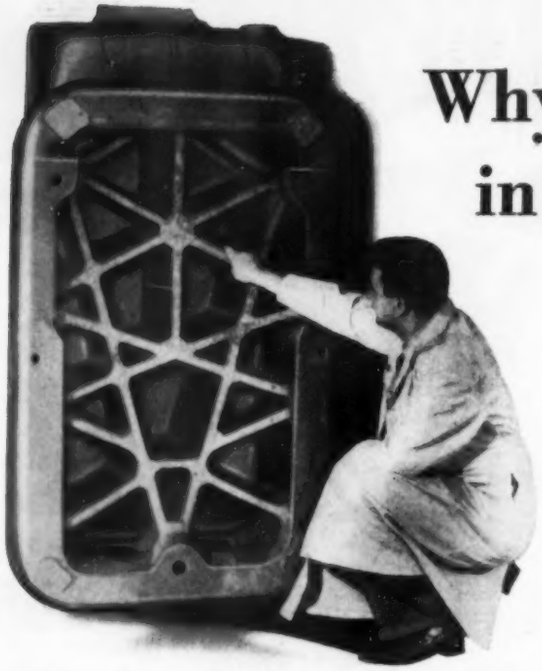
WORKS AT: Toledo, Cleveland, Salem, Ohio; Hastings, Mich.; Englewood, N. J.; Derby, England; St. Ouen sur Seine, France. SALES OFFICES AT: Detroit, Hastings, Mich.; New York, Rochester, N. Y.; Cleveland, Dayton, Toledo, Salem, Ohio; Philadelphia, Pittsburgh, Pa.; Chicago, Ill.; New Haven, Conn.; Windsor, Ont.

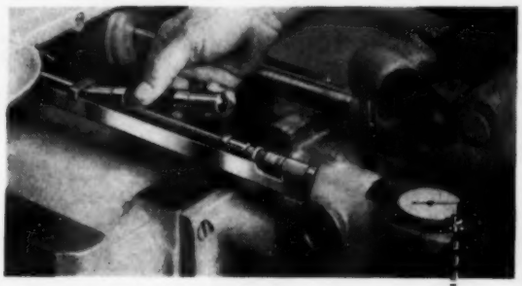
MARQUETTE · BLISS · CONSOLIDATED · TOLEDO ·

BLISS BUILT

BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY IN THE WORLD

Why accuracy "stays put" in the P&W Jig Borer





Here's a view Pratt & Whitney customers seldom get. But it shows up hidden strength . . . a mighty important feature of the P&W Jig Borer. The web-like ribbing is an integral part of the bed.

This machine carries a big load —column, table, carriage, and work — which it must support accurately in various positions. It is vital to precision boring that the machine *stay put*. That's the "why" of this unusual construction. Carriage, table and column are ribbed the same way.

The ribbing is planned and designed to give the greatest support and stability exactly where the load requires it. It is one more example of the hidden quality that is responsible for Pratt & Whitney Jig Borer accuracy.

The original jig borer was conceived and built by Pratt & Whitney about 30 years ago. It was a revolutionary development, and changed the whole toolroom concept of precision boring. Pratt & Whitney has been building jig borers ever since . . . with many *tested* improvements in convenience, speed and durability. The P&W Jig Borer is the most accurate of today's machine tools . . . will retain its initial accuracy through a long useful life . . . does the fast precision boring modern tool shop work demands . . . is an essential toolroom machine . . . first choice of experienced tool engineers. Complete literature is available . . . with many facts you should know about precision boring.

P&W Jig Borers use the time-proved P&W spacing method . . . basic measuring instruments . . . end measures for even inches, inside micrometers for inch fractions, plus dial indicators for measuring pressure control and visible safeguard against errors.

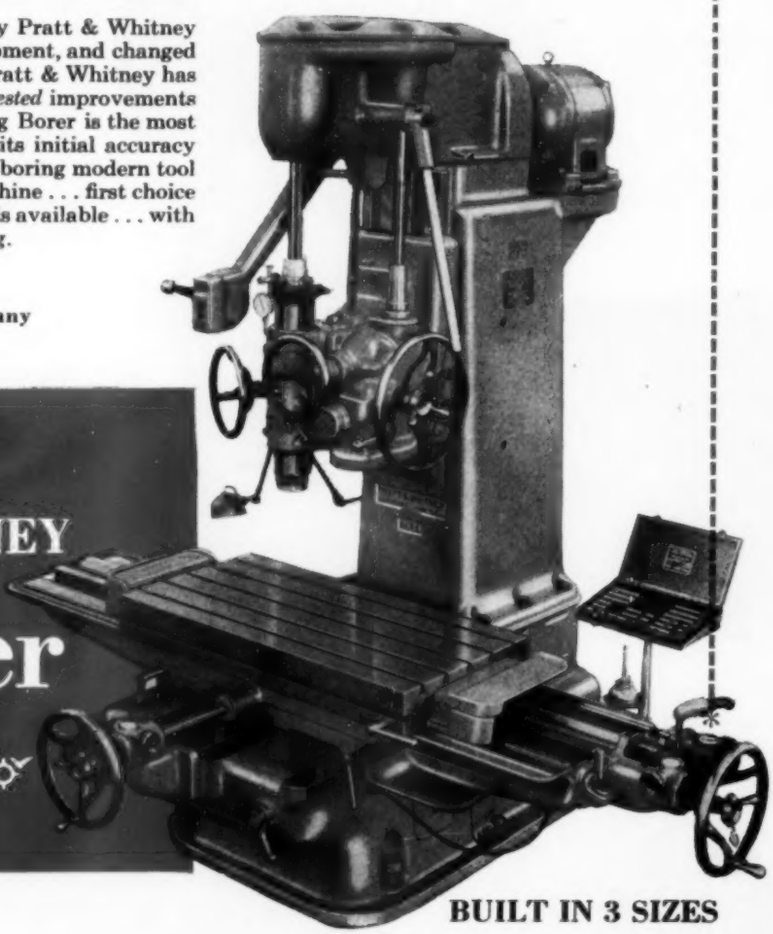
PRATT & WHITNEY
Division **Niles-Bement-Pond Company**
West Hartford 1, Conn.

Tool Shop Essential

PRATT & WHITNEY

Jig Borer

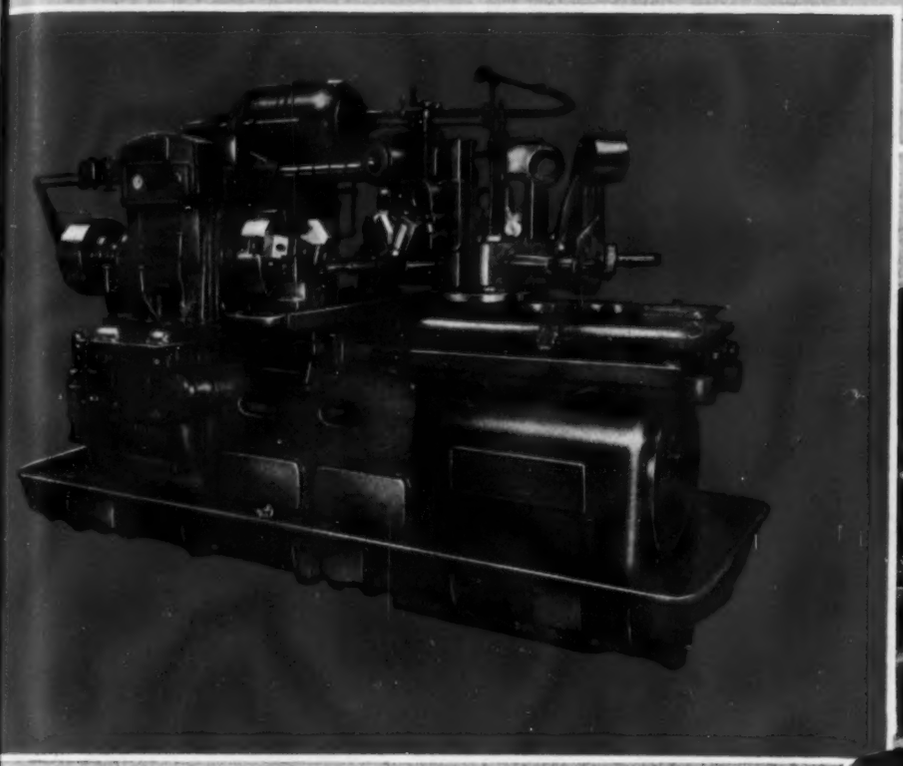
Locates + Bores ◇ Checks ◇



BUILT IN 3 SIZES

2.91 Minutes Floor-To-Floor Time on Gear Case Barrels

machined on a P&J 5D AUTOMATIC



The value of tooling flexibility as a means of stepping up production of duplicate parts and reducing costs is exemplified in the job shown here . . . handled on a P&J 5D Automatic Turret Lathe.

Five Machining operations are performed on the subject at a single setting of the work. Proper tooling, automatic changes of speed and feed as well as automatic binding of turret after indexing all contribute to the fast floor to floor time of 2.91 minutes per piece on this particular job.

Inasmuch as all P&J Automatic Turret Lathes are basically versatile, fast, powerful and accurate, we suggest that you ask P&J Methods Engineers to study your duplicate parts production problem and let them give you specific recommendations for meeting your requirements.

DETAILS OF JOB

Part: Gear Case Barrel
Material: Grey Iron
Methods and Operation:
Presenting long end to spindle grip on body at 2¼" dia. with 2 fixed jaws and on body and bolt flange with 1 swivel jaw.
Machine as follows:
1st. T.F.: Rough bore 2.063" dia. (2 holes) with hinged bar; rough face 3¼" dia.; turn and face 3.000" dia.
2nd. T.F.: Finish the above; break corners where necessary.
3rd. T.F.: Machine grooves in bore (Slide Tool).
4th. T.F.: Line ream 2.063" dia. (2 holes).
5th. T.F.: Size turn 3.000" dia.

PIONEER MANUFACTURER
OF AUTOMATIC TURRET LATHES

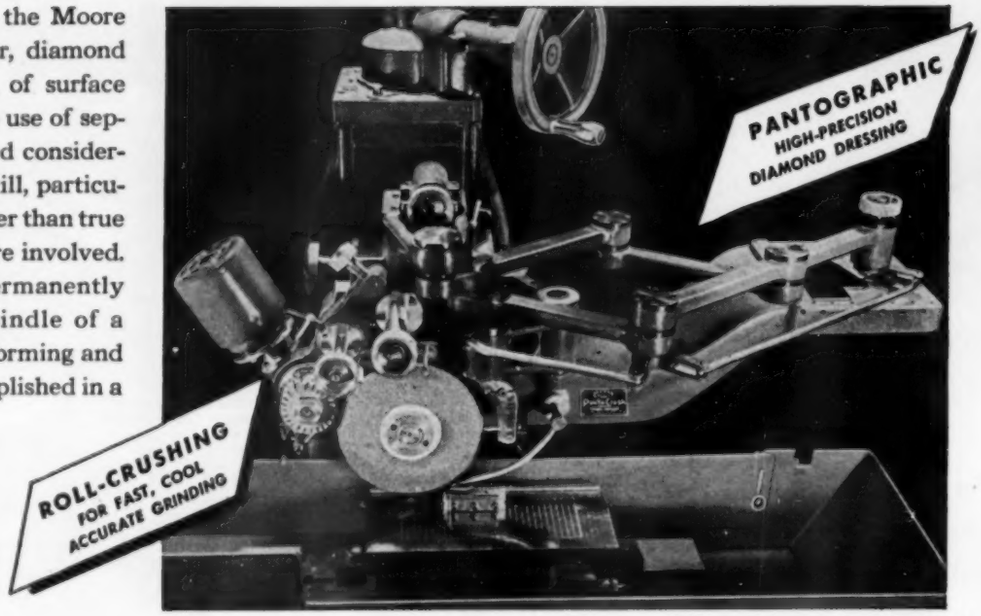
POTTER & JOHNSTON COMPANY, Pawtucket, R. I.
Subsidiary of PRATT & WHITNEY
Division of Niles-Bement-Pond Company

Now you can combine roll-crushing and diamond dressing in a single wheel dresser to speed form grinding

Before the development of the Moore Panto-Crush Wheel Dresser, diamond dressing and crush-forming of surface grinder wheels called for the use of separate devices. These required considerable set-up and operating skill, particularly where odd contours other than true radii and straight surfaces are involved.

Now with the Moore, permanently mounted on the wheel spindle of a surface grinder, both crush-forming and diamond-dressing are accomplished in a single mechanism.

Here's how this 2-in-1 machine does it:



1. Combines Pantograph, working directly from template, and *Roll-Crushing* in one device, accurately related to spindle.

2. Switches from one method to the other without disturbing workpiece setting or location of either trueing device.

3. No setting up of complex attachments each time wheel is dressed... no raising of wheel spindle from work to dress, yet wheel spindle may be raised or lowered without losing relation of wheel form to dressing device... crusher method saves diamond costs.

4. Assures highest roll-crushing accuracy and economy. Crusher roll is *ground* and *used* on same spindle, without disturbing position... no expensive machine required to grind crusher roll... no worry about hardening distortion, because roll is ground *in place* from the solid directly from template.

5. Takes Skill out of job, yet adds advantage of crush dressing for heavy cuts without heating work, and ultra-precision diamond dressing.

6. Device need not be removed to use machine as conventional surface grinder.

Both MACHINE DESIGN and MACHINERY magazines devoted considerable editorial space to technical discussions of the value of this ingenious new mechanism. We'll be glad to send you reprints and a descriptive catalogue on Panto-Crush.

MOORE SPECIAL TOOL CO., Inc.
738 UNION AVENUE, BRIDGEPORT 7, CONN.

HAVE YOU BOUGHT YOUR COPY OF "PRECISION HOLE LOCATION"?

Over 5,000 copies of this valuable book on toolmaking practices have been sold to date. Available at special price of $3 in U. S. A.; $3.50 outside U. S. A. 448 pages, over 400 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Send check or money order to Moore Special Tool Co., Inc., Bridgeport 7, Conn.

Add a MOORE to YOUR TOOLROOM

JIG BORERS · JIG GRINDERS · PANTO-CRUSH WHEEL DRESSERS
DIE FLIPPERS · COMPLETE LINE OF HOLE LOCATION ACCESSORIES

Decidedly FINER!

OUTSTANDING VALUE in the MEDIUM-PRICE FIELD

TIMKEN BEARINGS ON ALL SHAFTS IN HEADSTOCK

•

OVERSIZED HEAT-TREATED STEEL GEARS IN HEADSTOCK, ASSURING LONGER LIFE

•

ACCURACY .0005" AT EVERY POINT OF ALIGNMENT

GENERAL PURPOSE LATHES
Made in 12", 14", and 20" sizes. (16" shown here).

APRON CONTROL FOR START, STOP, AND REVERSE OF SPINDLE

•

REVERSE IN APRON FOR FEEDS

•

57 FEED AND THREAD CHANGES

•

TAPER GIBS THROUGHOUT

Sebastian GEARED HEAD LATHES

Now Manufactured By

KING

BUILDERS OF WORLD-RENOWNED "KING" BORING & TURNING MACHINES

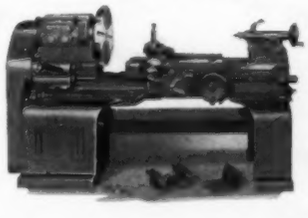
The Sebastian Lathe has long enjoyed a reputation for quality and dependable performance. Today—built in the ultra-modern King plant, with advantages of King engineering skill and production facilities—the Sebastian is an even *finer* lathe than ever before.

Here's definitely *more lathe for your money* . . . more in accuracy, in versatility, in operating ease, in improved construction and longer service life.

The modern Sebastian has all the features of large, high-priced production lathes, making it ideal for general maintenance, repair, and tool room work.

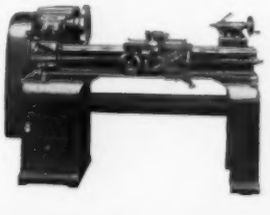
Many items are supplied as standard equipment, included in the basic lathe price—*more than with any other lathe of its type.* Among these are cabinet leg, tool posts, coolant pans, threading depth stop, and two face plates.

See your nearest Sebastian dealer. And send now for illustrated Sebastian Lathe Bulletin giving detailed information.



GAP LATHES
Made in 16" and 20" sizes

12" GENERAL PURPOSE LATHE



All Sebastian Lathes are equipped with 8-Speed Geared Heads

American Steel Foundries

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

Builders of Vertical Boring & Turning Machines and Sebastian Lathes

Tests prove them 3 to 10 times better

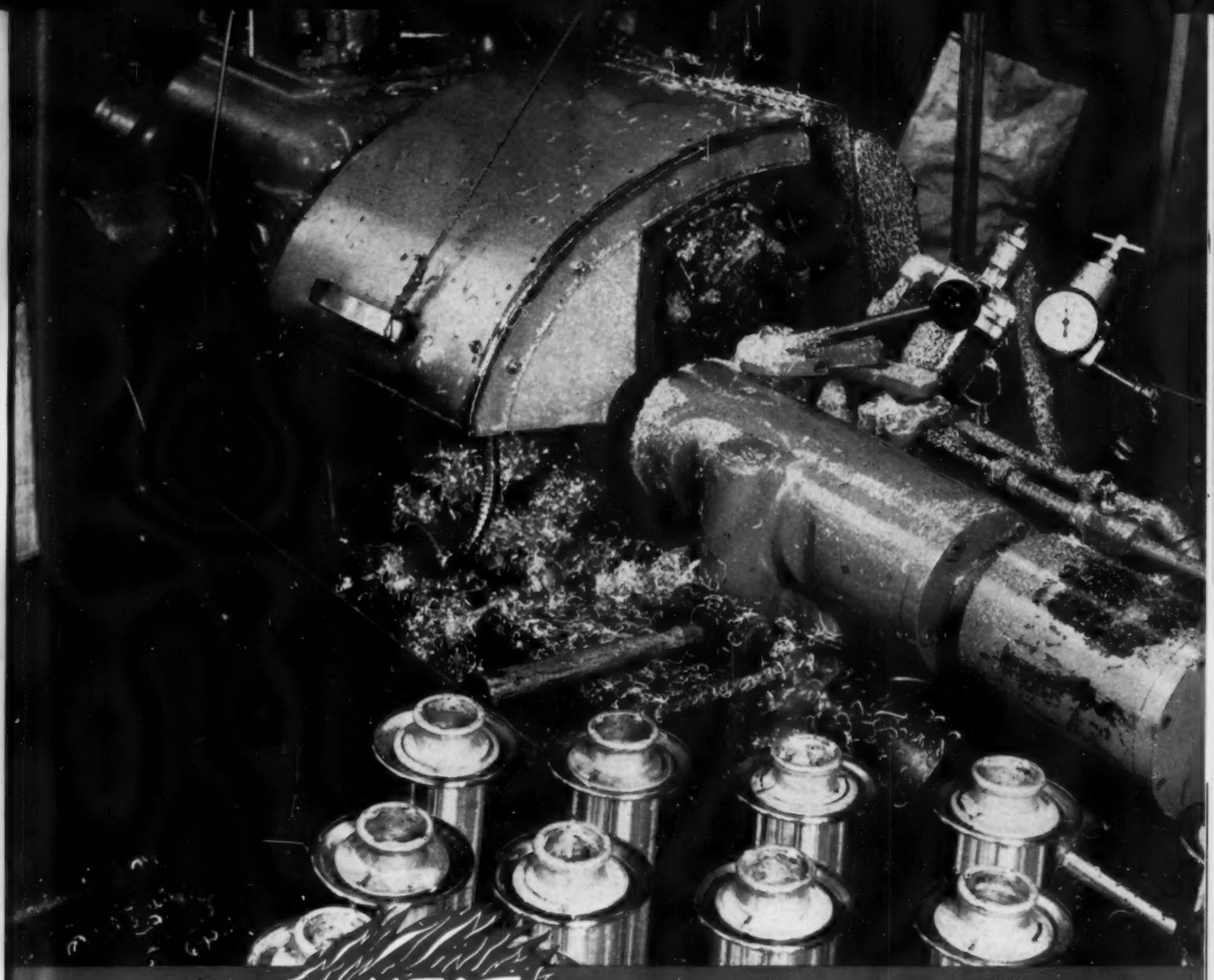
Gorham

M-40-U ALLOY CENTERS

GORHAM "M-40-U" is a special alloy developed by the Gorham Tool Company expressly for use as a wear and abrasion resistant metal. So superior is this alloy that by *actual test* it has shown results 3 to 10 times better than high speed steel and other alloy materials for centers. Standard M-40-U alloy tipped centers can be furnished from stock. ★ ★ ★ Special M-40-U Alloy centers can be furnished to your specifications, or our engineering department will assist you in the design of special centers to meet your needs. Choose GORHAM "M-40-U" for top performance and long wear.

GORHAM TOOL COMPANY

14400 WOODROW WILSON DETROIT, MICH.



Takes off the *HEAT* in magnesium machining

FIVE OR SIX FIRES were started every day by burning magnesium chips in a midwest metalworking plant. Not only was plant safety jeopardized, but valuable production time was used to combat the frequent blazes.

The trouble occurred when solid cylinders of magnesium were machined into bobbins. The largest of these bobbins, or textile spools, are six feet in length with a cylinder diameter of one foot and a rim diameter of two feet.

One cutting oil after another was tried on this "hot" machining job. They all failed to reduce the number of fires until Stanicut 62 FC was tested in one machine. Stanicut solved the problem and has since been installed in all the machines. After six months of service, it has not only eliminated all fires but also has increased tool life and improved the finish on the bobbins.

Many difficult and unusual machining problems have been solved with the help of a Standard Cutting Oil Engineer and the use of Standard cutting fluids. Why not utilize this expert service to get maximum efficiency on your operations? Write Standard Oil Company (Ind.), 910 S. Michigan Ave., Chicago 80.

Stanicut 62 FC

STANDARD OIL COMPANY (INDIANA) STANDARD

Gives products longer life

...2½ times longer for hedge trimmer

Tests of many greases were made before Stanolith Grease was selected to lubricate this Pincor Electric Hedge Trimmer.*

The worm gear is driven at 17,000 RPM. Gear box temperatures may reach 180°F. The lubricant is subjected to moisture from condensation. Stanolith resisted both heat and moisture. It did not channel or leak. Gears lasted 2½ times longer with Stanolith than they did with any other lubricant tested.

To give your mechanical products a head start in life, use Stanolith. It is lubricating successfully such widely different products as fishing reels and ironer gears. It has also many cost-saving applications in the lubrication of plant equipment where the combination of heat and moisture pose a problem.

A Standard Oil Lubrication Engineer will be glad to discuss the application of Stanolith Grease to your product or to your plant lubrication problems. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

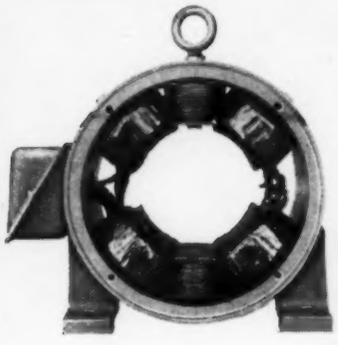
Stanolith Lithium Soap Grease

***Manufactured by Pioneer Gen-E-Motor Corp., 5841 W. Dickens Ave., Chicago 39, Ill.**

STANDARD OIL COMPANY (INDIANA) STANDARD

Century Direct Current Motors

Correct Design, Rugged Construction Mean Long Life and Top Performance

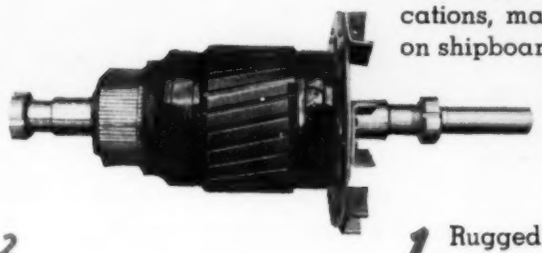


1

Century 3 horsepower Direct Current open rated (1249A) ball bearing motor, equipped with protecting covers

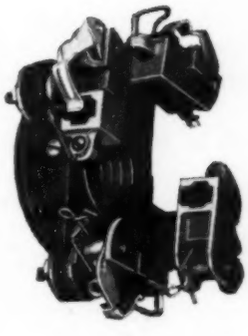
Nearly 50 years of experience and know-how have gone into the development of modern Century Direct Current motors. From this background Century engineers have developed a complete line of DC motors from 1/6 to 300 horsepower — available for any application where direct current is used.

Typical applications are wire drawing machines, steel mill applications, machine tools, motion picture machines, marine equipment on shipboard, cranes and hoists, oil field equipment and applications requiring adjustable voltage speed control.



2

Here are some of the construction features that make them rugged, sturdy, dependable sources of electric power.



3

1. Rugged steel frame with accurate machining. Stays rigid, maintains proper air gap between field and armature. Windings are neat, compact, thoroughly saturated with insulating compound.
2. Armature is built upon a stiff steel shaft. Mica insulated commutator is large. Large fan assures adequate ventilation.
3. Strong, durable brass brush holder keeps brushes securely in position. Rugged construction contributes to long life. (Shown mounted on inside bearing cap.)
4. Illustration is of a splash proof end bracket assembly for ball bearing motor. Accurately machined to maintain shaft in alignment.

These and other features of Century Direct Current motors contribute to their long life of top performance.

4

In addition to DC motors, Century builds a complete line of electric motors and generators from 1/6 to 400 horsepower to meet the requirements of industrial and commercial applications.

Popular types and ratings are available from factory and branch office stocks.

Specify Century motors for all your electric power requirements.

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Offices and Stock Points in Principal Cities

Century C MOTORS

● Note that these Engineer's Pattern "Superrenches" are thin enough to operate jam nuts.

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"Superrenches"

Awkward, hard-to-reach adjustments present no problem for these streamlined "Superrenches". Forged from alloy steel, they are light in weight yet their strength is equal to that of the strongest wrenches made. Available in all popular patterns, with openings from 3/16" to 3-1/8". "Superrenches", with highly polished heads, are handsomely finished in durable chrome plate, over nickel.

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Figure your machining speeds—your operator time—your daily requirements—and your down-time. It will show you why more and more smart production men are turning to the No. 12 Hydraulic for a consistent volume of work.

GISHOLT No. 12 HYDRAULIC AUTOMATIC LATHE

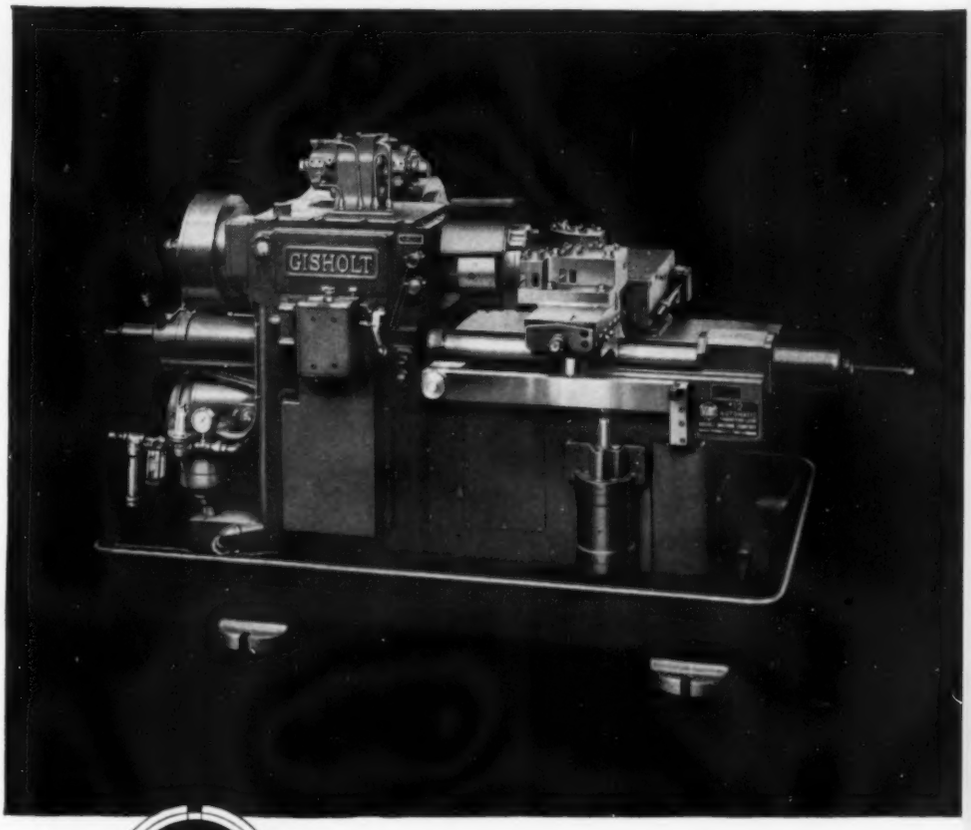
These are important factors in cutting the cost of machine minutes—and in cutting the unit cost of many parts.

Easier Job Set-ups—No cams or drums. All adjustment points for slide control are conveniently placed between shoulder and knee levels—open and accessible. Tool blocks and tool bits are simple to position. There's no time lost here.

Faster Machining—This advanced automatic lathe has the speed and ruggedness for the toughest high production work.

Easy to Operate—One operator can tend two or more machines. Tool bits are quickly adjusted or replaced during runs.

Simple Construction—There are fewer parts requiring adjustment or replacement. You expect less and have less down-time with the No. 12 Hydraulic. Write for the catalog—Form 1104A.



THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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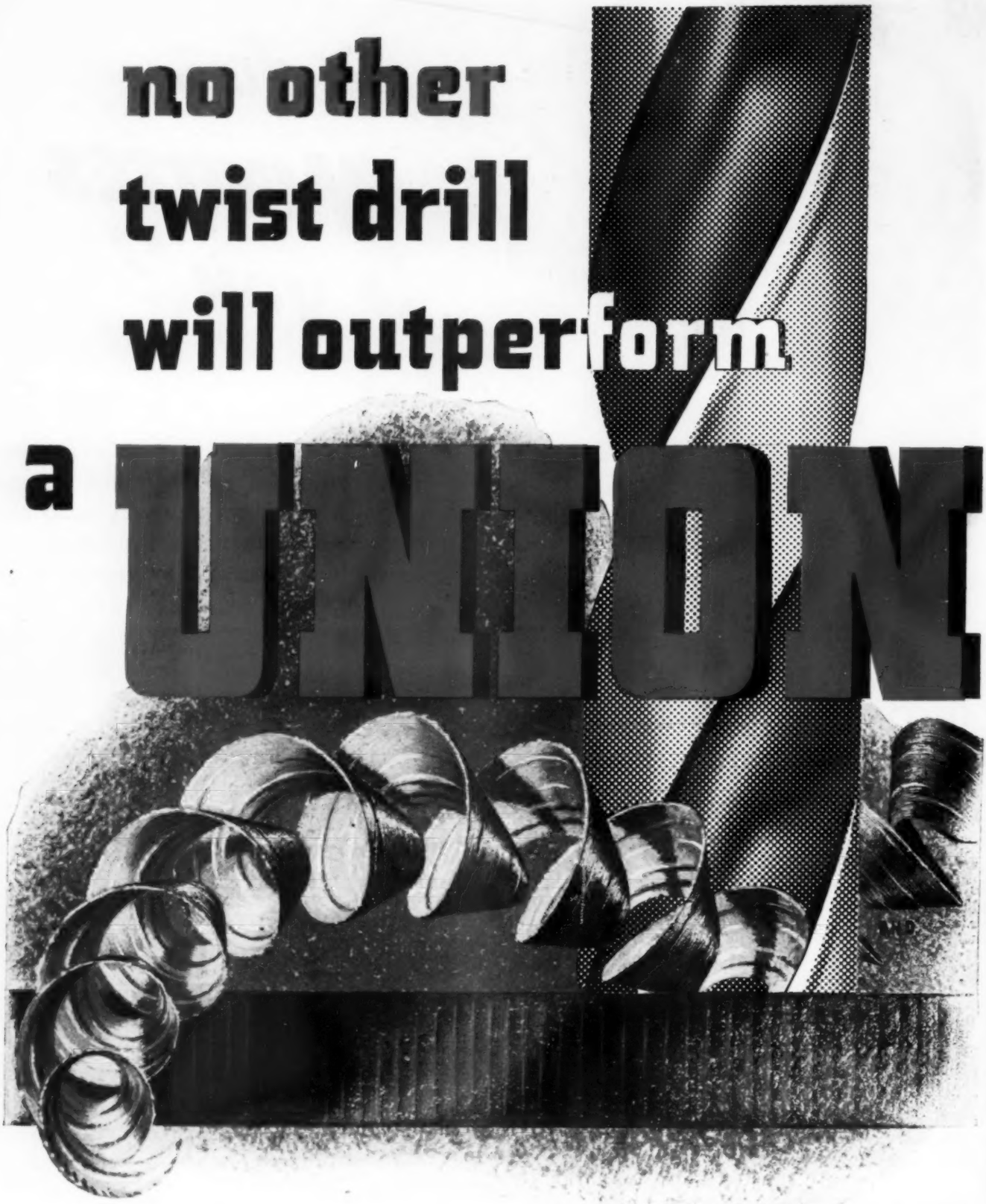
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

no other twist drill will outperform a UNION



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NEW! The Art OF BLANCHARD SURFACE GRINDING

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MATERIAL: Soft, Low Carbon Steel, Steel Castings, Malleable Iron, Steel Forgings, Soft Alloy Steel.

	PIECES MATERIAL	SURFACE	STOCK REMOVAL FINISH* LIMITS	CHUCK PIECES ON CHUCK TOTAL AREA	TABLE SPEED FEED	WHEEL
Plate 13	FILTER TANK Welded Steel		1/16" Good Flat	No. 18-36" 1 49 sq. in.	33 RPM .024"	24F50 (1)
	METEROL VALVE BODY Cast Steel Plate 13		1/32" Commercial ±.002"	No. 11-16" 12 72 sq. in.	24 RPM .022"	24F40
	SPROCKET BLANKS Boiler Plate		1/32" A Side Commercial −0.000", +.005"	No. 16-30" 3 132 sq. in.	20 RPM .020"	24F50
Plate 14	JACK BASES Malleable Iron Plate 14		3/16" Commercial ±.005"	No. 18-36" 35 104 sq. in.	18 RPM .018"	24F50
Plate 15	RUBBER SOLE MOLD PLATE Speed Case Steel Plate 15		1/16" A Side Commercial ±.002"	No. 18-36" 1 576 sq. in.	33 RPM .012"	24F50
Plate 16	MAGNETIC CHUCK Soft Steel Plate 16		.030" Water-tight Joint Flat .0003"	No. 27-60" 1 2130 sq. in.	5 RPM .004"	24F50 Segments

(1) A 24F30 would normally be used for this narrow surface. A softer wheel was used to reduce overturning force.

*Finish classifications in micro-inches: Commercial, 25-50 micro-inches; Good, 12-25 micro-inches; Fine, 2 to 12 micro-inches.

This new Booklet, "The Art of Blanchard Surface Grinding," will assist you in obtaining the superior quality and quantity performance inherent in Blanchard Grinders.

Every owner and operator of a Blanchard Surface Grinder should send for this 48-page booklet. It is packed full of information to show you how to get maximum performance.

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Without obligation, please send me the new booklet, "The Art of Blanchard Surface Grinding."

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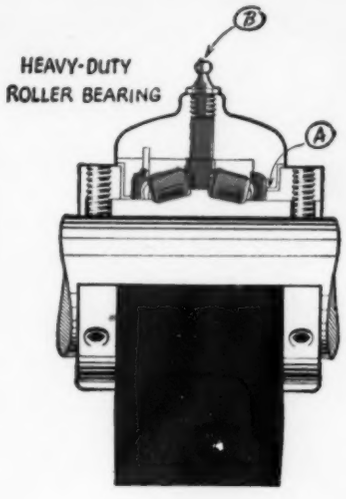
TO OBTAIN THE LONGEST WEARING GAGE
Request a NORBIDE Gage
then *DOUBLE* gage life again by making it *REVERSIBLE.*

NORBIDE plug gages, along with many other types of NORBIDE gages, have long been known to gage users for their exceptionally long-wearing qualities. NORBIDE gages are made of Norton Boron Carbide which is the hardest material made by man. Gage life has often been increased up to one hundred times by the use of NORBIDE members in the gages.

Some gage suppliers are further doubling plug gage life by producing reversible gages. As one end of either the "go" or "no go" member becomes worn, it may be removed from the handle and reversed with the unworn end thus being made available for further long gage life. Your regular gage supplier should be able to provide NORBIDE gages or, *for further information, we invite your inquiries.*

NORTON COMPANY, WORCESTER 6, MASS.

CASE 1065—SECURING POSITIVE BEARING LUBRICATION IN HIGH RADIATED TEMPERATURES.



Calol S. A. Grease stopped leakage and drippage trouble in a large roller bearing even when bearing temperature, due to radiated heat, reached 250°F. and over. Originally developed for heavy-duty anti-friction bearings, but adaptable to many industrial grease-lubrication services where high ambient temperatures exist. Three grades: No. 00, No. 0 and No. 1.

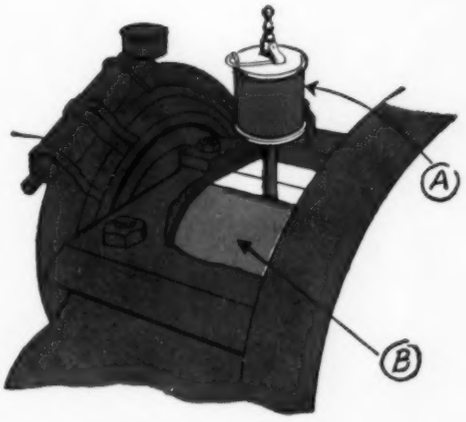
Has sodium-aluminum soap base - feeds evenly through bearings ... oil stock selected for high heat-resistant qualities.

A. Minimizes seepage through housings and seals.

B. Resists cold temperatures - pumpability remains good in all weather.

Calol S.A. Grease has proved excellent for low-, medium-, and high-speed anti-friction bearings. It is packed in 35-, 108- and 420-pound containers.

CASE 1063—REDUCING CONSUMPTION OF OIL USED FOR GENERAL INDUSTRIAL LUBRICATION.



STEAM ENGINE MAIN BEARING

In severe lubrication conditions, such as in the main bearing of a steam engine, consumption of compounded Calol Red Engine Oil X was 20 to 30 percent less than that of straight mineral oil. It is recommended for all types of bearings except high-speed, flood lubricated, anti-friction bearings where pickup may be excessive. Comes in three grades: 13X, 16X and 26X.

A. May be applied by all types of oiling systems - compounds promote better circulation in ring-, and chain-oilers.

B. Contains stringiness and oiliness additives. Forms tacky "oilskin" on bearings - resists heavy loads and high temperatures. Reduces friction, high starting torque and wear.

Calol Red Engine Oil X has excellent metal-wetting ability - protects metal against rusting even in high humidity conditions. Cools rapidly.

For additional information and the name of your nearest Distributor, write

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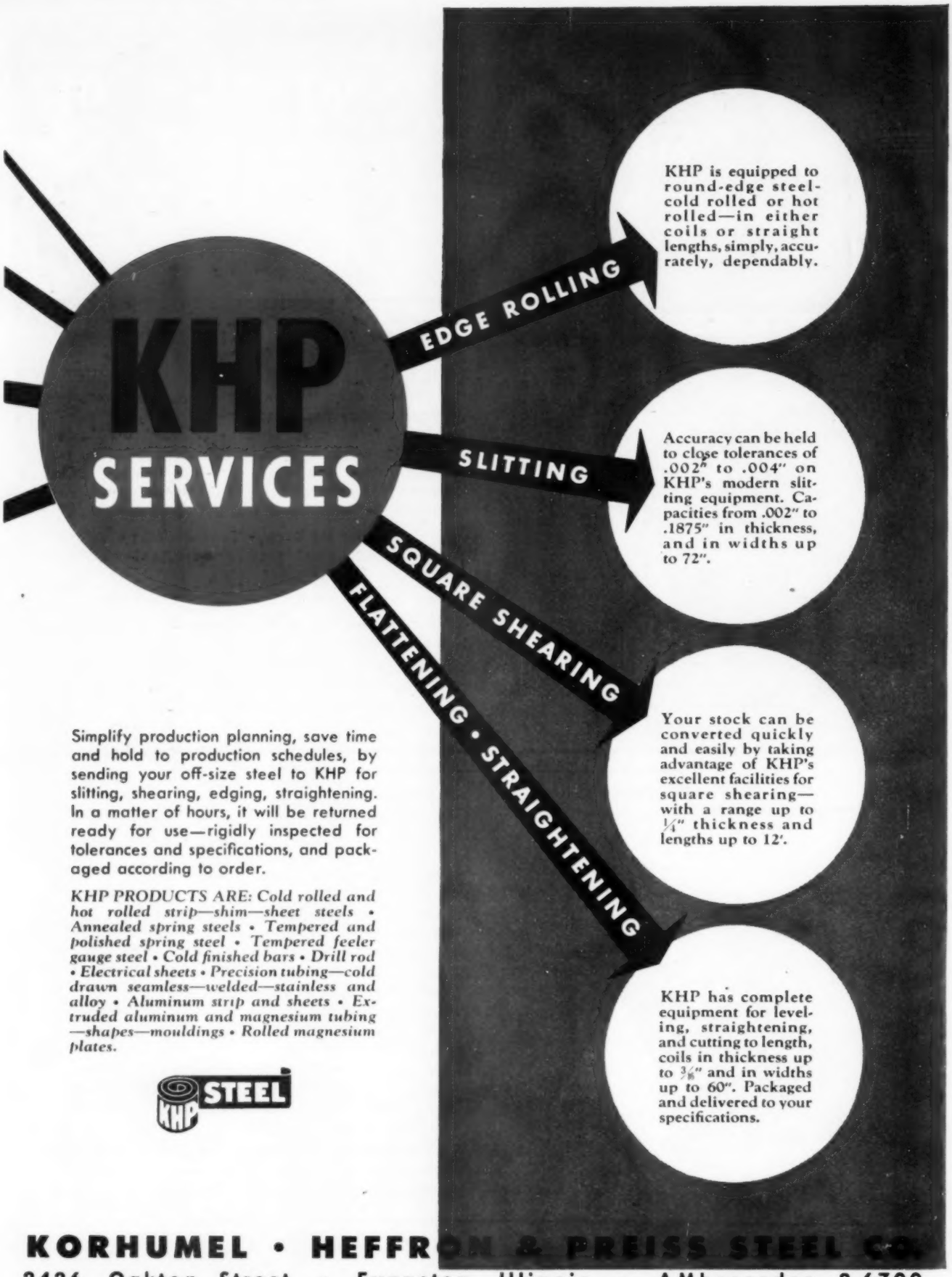
KHP
SERVICES
EDGE ROLLING
KHP is equipped to round-edge steel-cold rolled or hot rolled—in either coils or straight lengths, simply, accurately, dependably.
SLITTING
Accuracy can be held to close tolerances of .002" to .004" on KHP's modern slitting equipment. Capacities from .002" to .1875" in thickness, and in widths up to 72".
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Your stock can be converted quickly and easily by taking advantage of KHP's excellent facilities for square shearing—with a range up to ¼" thickness and lengths up to 12'.
FLATTENING • STRAIGHTENING
KHP has complete equipment for leveling, straightening, and cutting to length, coils in thickness up to 3/16" and in widths up to 60". Packaged and delivered to your specifications.

Simplify production planning, save time and hold to production schedules, by sending your off-size steel to KHP for slitting, shearing, edging, straightening. In a matter of hours, it will be returned ready for use—rigidly inspected for tolerances and specifications, and packaged according to order.

KHP PRODUCTS ARE: Cold rolled and hot rolled strip—shim—sheet steels • Annealed spring steels • Tempered and polished spring steel • Tempered feeler gauge steel • Cold finished bars • Drill rod • Electrical sheets • Precision tubing—cold drawn seamless—welded—stainless and alloy • Aluminum strip and sheets • Extruded aluminum and magnesium tubing—shapes—mouldings • Rolled magnesium plates.

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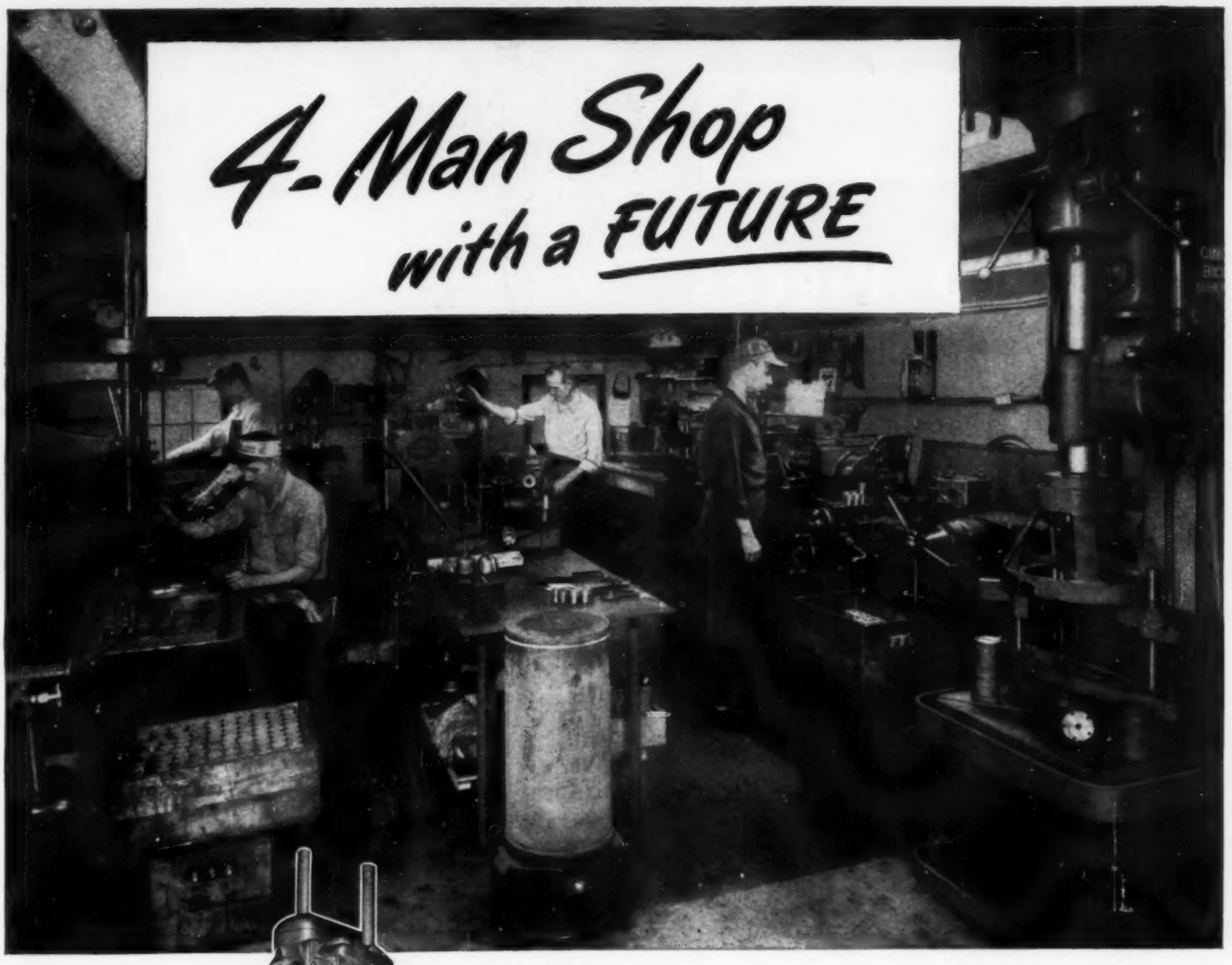
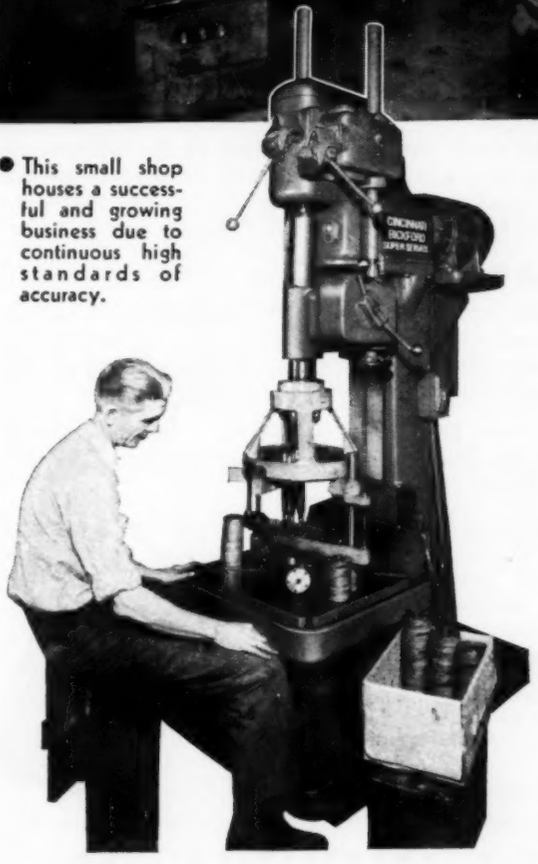
4-Man Shop with a FUTURE





● This small shop houses a successful and growing business due to continuous high standards of accuracy.

Quality equipment pays the small operator as well as the large.

The Schoening Machine Service, 3284 Dunn Street, Cincinnati, Ohio—business, production machining—small in size—big in accomplishment—testifies to the value of fine tools.

The Cincinnati Bickford Super Service Upright Drill, illustrated, is drilling five $\frac{11}{32}$″ holes and four $\frac{11}{32}$″ holes to a plus or minus .005″ tolerance in a steel cover $\frac{5}{16}$″ thick—a production job.

Mr. Schoening tells us he has held accuracy to a plus or minus .0002″ on production reaming jobs.

Write for Bulletin No. U-25.

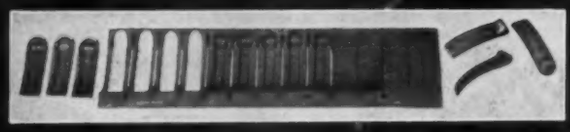
THE CINCINNATI BICKFORD TOOL CO.

RADIAL AND UPRIGHT SUPER CB SERVICE DRILLING MACHINES

Radials 7½″ dia. col., 2½′ arm, to 36″ dia. col., 12′ arm.
General purpose Uprights, 21″ to 28″ sizes.
Production Uprights, 21″ to 28″.
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.



120 Pieces Per Minute ...from 3½" x .018" Brass

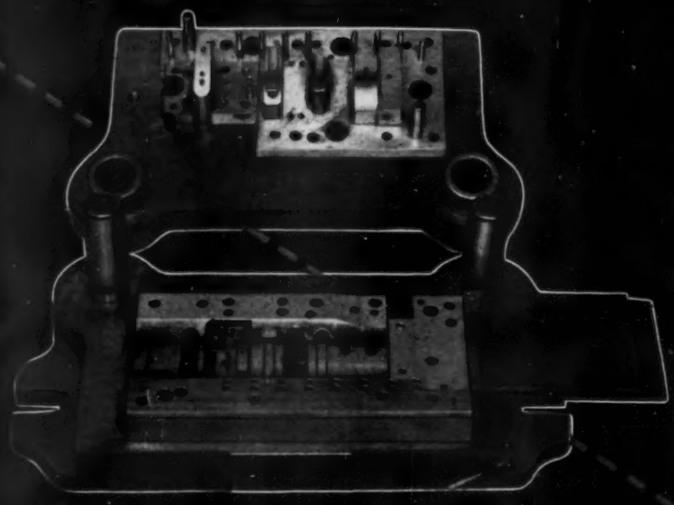


Photo courtesy of Federal Tool Corporation, Chicago

...using DANLY Precision Die Set

Precision Guiding Required on Deep Blanking Tool

Here is another example of how Danly Precision Die Sets help maintain accurate punch and die relationship on high production work. The part illustrated, a slide cover, is produced at a rate of 120 pieces per minute on the 11-station progressive die and a Danly Standard Precision Semi-Steel Die Set.

An unusual deep blanking tool used in the last station requires precision guiding by the Danly Die Set to prevent breakdowns and assure peak performance. The blanking punch at this station enters the die a distance of 5/16".

Sequence of Operations

Brass coil stock, 3½" wide x .018" thick, is automatically fed through the following operations: Pierce pilot hole, slit, first form, idle, draw shape, pilot, restrike shape, pierce, idle, blank, pilot in scrap.

To date, over 3,000,000 pieces have been produced with the same Danly Die Set. An average of 200,000 pieces per grind is obtained.

Helpful Engineering Service — For helpful engineering service on die sets of any size, standard or special, for any type of press operation, consult Danly without obligation.

Save Time...

Use DANLY Nation-Wide Die Set Assembly Service

Assembly plants (marked with stars) stock interchangeable parts for quick assembly and delivery of any standard die set to your specifications.

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- ★ **Cleveland 14,** 1550 E. 33rd St.
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Illustrates how Danly special machining and welding facilities help you save time and money on special die set applications.

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DANLY MACHINE SPECIALTIES, INC.
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25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

PRECISION DIE SETS...STANDARD AND SPECIAL • MECHANICAL PRESSES AND PRESS EQUIPMENT

SPOT NEWS OF METALWORKING

Production problems may delay Chevrolet's program for automatic transmission. Management is reported considering use of a fluid-drive control rather than a torque converter.

Italy is planning to buy $50 million of U.S. machine tools, and Holland $5 million, under the Marshall Plan, say unofficial reports.

Cycleweld construction was used in building the hull of the boat which survived the rough water in the recent Gold Cup Race at Detroit.

French are proceeding with plans for dismantling 38 German plants in French zone in western Germany. Twenty percent are classed as war plants, 20% as non-ferrous metal-processing factories, and 40% as watch factories. Two big Germany watch factories, Junghans and Krienzle, are included.

Productivity per manhour in the machine tool industry in 1947 was only 91% of what it was in 1939, according to preliminary figures from Bureau of Labor Statistics. This is a drop from 94% in the previous year. In construction machinery, productivity was 95%.

India will need $600 million of machinery and other capital goods from this country in the next five years. Main items: machine tools, $90 million; ships, $90 million; textile machinery, $30 million; boilers and engines, $100 million; automotive equipment, $60 million. General feeling in India is that U.S. industrialists are overstressing the needs of Europe while overlooking a promising market in southeastern Asia.

Tip on how to get a new automobile: supply the motor car producer with pig iron. The facts are: president of foundry making automotive castings phoned head of pig iron producing company and said, "Do you know anyone in your organization who wants immediate delivery on any make of car? I can get you the cars if you can give me more pig."

WAA has yet to dispose of $65 million of machine tools, $9 million of cutting tools, $12 million of metal forming and cutting equipment, and $2 million of abrasives.

Buick 40 will be modified and in production for '49. Tooling is under way to permit application of dynaflow drive, which will be optional equipment beginning next May or June. All Buick 50 and 70 models will have as many dynaflow units as production will permit. Buick is to buy station wagon bodies from Iona, Mich., body company.

United Plant Guard Workers of America has been granted by NLRB an election among 600 plant patrolmen and fire marshals in 12 Chrysler plants in the Detroit area. It is the first bargaining election ordered among plant protection personnel under the Taft-Hartley Law. UPGW is an independent union formerly affiliated with the CIO.

Each plant foreman attended at least one session of meetings between SKF Industries, Inc., and International Association of Machinists during contract negotiations at SKF's Hornell, N. Y., pillow-block plant. Participation of foremen was designed to instill in them "a greater acceptance of their managerial responsibilities."

Gaging Metalworking

The metalworking industries promise to operate at a high level during the fourth quarter. Many lines — automobiles, farm implements, household appliances, industrial machinery, turbines—will limit output only by the amount of steel available. Continued good business will prevail in both durable and consumer goods.

There are many favorable factors. Consumer income is at record level. Postwar expansion programs have not been completed as early as anticipated; they will stretch out well into 1949. Defense and ECA spending will be felt in greater measure as the weeks go by. Farmers are harvesting bumper crops and their cash income will be very large. Unemployment is practically nonexistent.

Some weak spots show up, to be sure. Inventories of finished goods are starting to pile up. The international situation hardly inspires confidence in the future. Some soft goods lines are not doing well. Orders for machine tools have been below expectations. But even so, metalworking operations in general should carry along close to the volume experienced thus far in 1948.

Steel Users Take Dim View

Steel consumers, especially those using sheet and plate, take a dim view of the future. The government's voluntary allocation program bites more and more into the available supply of steel. As a result, less so-called "free" steel can be had today than a few months ago. The situation will get worse before it gets better. Example: nearly 30% of steel plate output is now being allocated; by early next year, allocations probably will rise to 40%. If this happens, some continuous sheet mills will use their facilities to make plates, thus aggravating the sheet situation.

Steel Set-Asides Are Large

Pressure on steel is so great that users are turning to (1) higher percentage of premium steel purchases, (2) more conversions, (3) more substitutions. Some big consumers are trying to acquire all the conversion tonnage possible at lowest cost. Their steel requirements are rising at the same time that voluntary allocations are expanding. This "double-squeeze" on mills is terrific.

If the voluntary set-aside rate (5.7 million tons annually) is added to export and foreign-aid estimates, the total of "earmarked" steel mill products is 12.2 million tons, or roughly 20% of the nation's output.

Up to now, automotive industry and other users not under the allocations program have not been hurt much by the set-asides. But they are worried about the last two months of this year and the early part of next.

Aluminum Outlook Dark

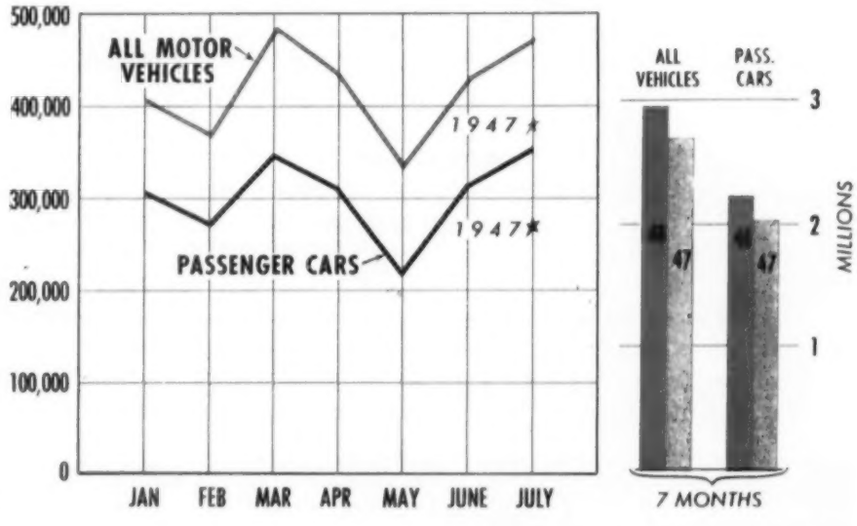
Aluminum, including aluminum scrap, is in almost as tight a situation as steel. It now appears that 1949 will be more critical than now. All producers are allocating their output; chances are that customers will get less aluminum next year than this year. Aluminum scrap is very important in insuring a supply of aluminum in all forms, provided it is channeled to primary producers and secondary smelters. That is why some users of aluminum are confining their sales of aluminum scrap to producers and secondary smelters who are their suppliers.

Stockpiling Hurts Copper

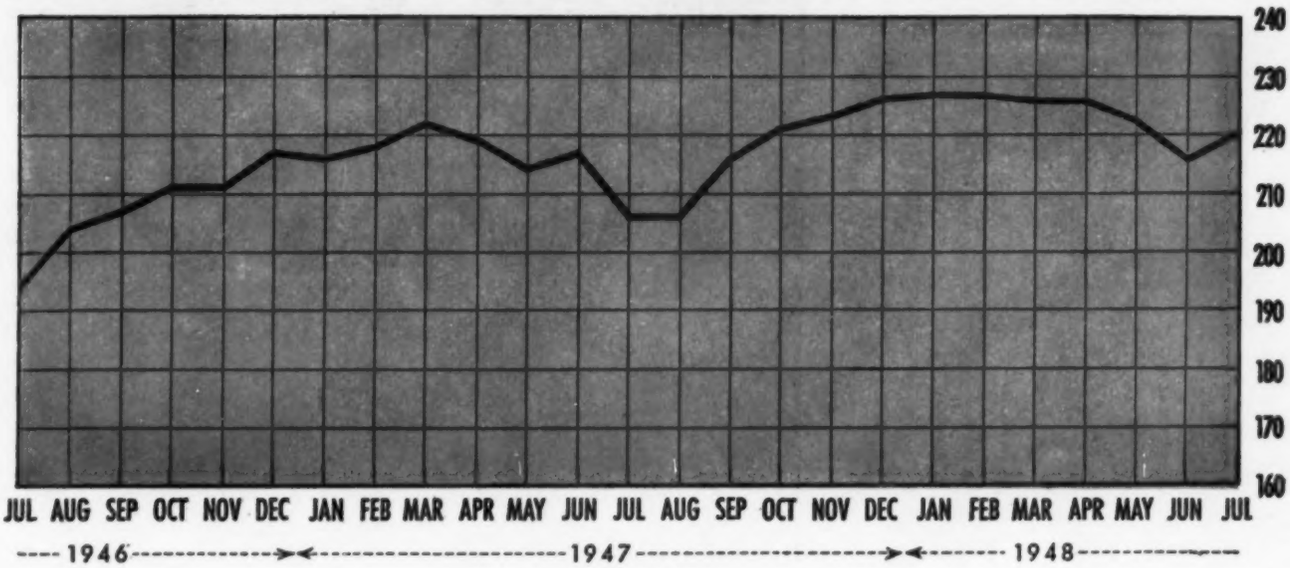
Though copper prices rose recently, some consumers were able to lay in enough material at the old prices to tide them over the remainder of this year. The stockpiling by Washington is of deep concern to users, who assert that a copper shortage will be created during the final quarter and well into 1949 if the

Passenger Car Output Follows Pattern of Total Motor Vehicle Output

	PASSENGER CARS	MOTOR VEHICLES
JULY 1947	279,631	379,192
7 MOS. 1947	2,001,022	2,727,839
JAN. 1948	305,081	405,651
FEB.	274,847	382,991
MARCH	349,999	492,013
APRIL	308,071	439,092
MAY	225,461	339,531
JUNE	312,405	431,033
JULY	356,582	474,387
7 MOS. 1948	2,132,446	2,962,688



American Machinist INDEX OF METALWORKING PRODUCTION



INDEX		COMPONENTS				
		MACHINERY	ELECTRICAL MFG.	AUTOS, TRUCKS	TRANS-PORTATION EQUIP.	OTHER METAL-WORKING
JULY 1948.....	220	250	226	229	305	147
JUNE 1948.....	216	250	227	217	282	148
JULY 1947.....	206	230	226	212	261	141

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1. Index figures are a percentage of 1939, which equals 100.

government continues to take large quantities.

Tin is still far short in supply compared with demand. Controls hence will be continued indefinitely. The lead situation has been hurt by the strike at St. Joseph Lead. Some users have made up the deficit by purchases from other sources, without being assessed premium prices. Lead production continues behind demand.

Machine Tool Situation Spotty

Many machine tool builders could use new orders in substantial volume to bolster flagging production. The industry as a whole continues in an extremely spotty condition. One company is doing well; another is in a low spot. Some builders say that important retooling programs, such as those in the automotive field, are being held up until managements decide whether defense business may interfere with their production of peacetime goods.

ECA Poor Source of Orders

Defense orders in machine tools, as a matter of record, have been disappointing. Some have been placed, but not in the large volume anticipated. ECA still is a very poor source of machine tool business. European countries are reluctant to spend their dollars for U.S. machine tools. At this time, prospects of sizable orders from Marshall Plan countries are extremely slim for the remainder of this year.

Erroneous reports have been circulated that deliveries of U.S. machine tools are poor, that months elapse before users can get machines. That is not true. On some general-purpose machines, deliveries are immediate or no longer than a few weeks. Even more specialized machines can be turned out in five months to one year. By contrast, British builders are quoting from six months to two years.

Tool and Die Sales Gain

Sales invoiced by contract tool and die shops have spurted upward and for the first time this year passed the total for the same period in '47. The volume, however, still is slightly under the cumulative amount for the year to date, compared with last year. The industry's backlog has varied little all year, staying close to the 1947 level.

New orders booked have been running ahead of last year's record. Shops in New England and the Middle West report plenty of inquiries: these inquiries encourage managements to look for a pick-up in business during the fourth quarter.

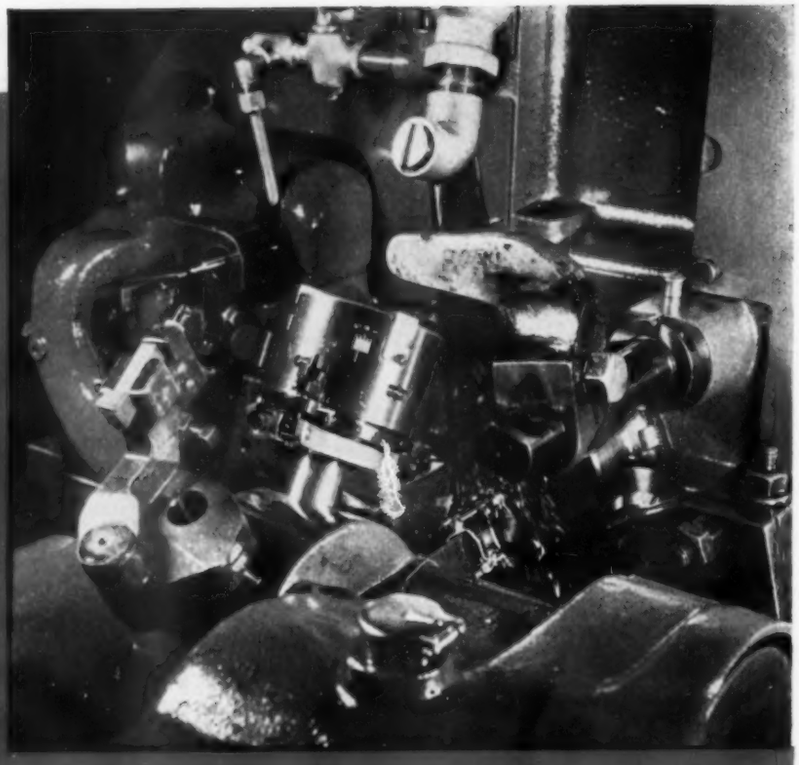
Die Shops Need Men

Tool and die manufacturers in New England have had a brisk increase in orders. Their sales curve slumped badly early in the summer, but recovered in recent weeks. Springfield, Mass., Hartford and Bridgeport shops in particular are doing well.

Shops in Cleveland, Chicago, Milwaukee, Indianapolis and smaller Indiana centers are looking for experienced men. Activities in Detroit have sagged because much of the retooling work for General Motors and Chrysler divisions has been completed. Almost half of the nation's tool and die shops report the outlook as excellent or good.

Foundry Equipment Sought

New foundry equipment orders rose during July to $4,203,724 from the June figure of $1,810,361. Shipments of new equipment and repairs in July dipped to $2,334,855 from the previous month of $2,807,639. Backlog of new equipment orders rose approximately $100,000 to $8,533,789.



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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Technological Stagnation?

The decline in number of patent applications in this country is cause for concern.

The all-time high for such applications was back in 1929. There was a drop of almost 40% during the depression, but in 1946 they came up again close to the 1929 level. Since then they have dipped abruptly.

Between 1900 and 1930 our population increased 61%, and patent applications 130%. In the years since 1930 the population has risen 15%. Patent applications, however, decreased 15% in that period.

This situation has worried the Machinery & Allied Products Institute so much that it recently issued a bulletin on the matter.

It calls attention to the happenings in Britain. At the same time that patent applications in Britain were falling off sharply, the country was experiencing a technological decline.

The MAPI bulletin says, "Anyone who has as much at stake in technological advancement as the capital goods manufacturer may have reason to be concerned about the downward trend in applications for U.S. patents."

No one can be sure of what the explanation is of this decline in inventions. MAPI suggests a number of reasons. The standard of invention has risen. There is a widespread feeling that patent protection of inventions has suffered seriously from adverse court decisions.

Then, fewer foreigners apply for patents today than when countries like Germany, England, France and Italy had relatively free capitalistic economies. Concentration of manufacturing in big companies may tend to make patents less important. And slow response from the Patent Office on applications may discourage those who have dealings with it.

Granting the influence of all of these factors, we believe that MAPI came closest to the true explanation when it cited the difficulties of starting a new business. We quote:

"A generation ago a business-minded mechanic or engineer with an idea could start a business based on his patent, and that has been the origin of thousands of American companies.

"Today such a man looks at taxes, government regulations, union labor problems and similar hazards, including the complexity of modern technology, and decides to remain an employee.

"In short, the incentive is largely gone for the small entrepreneur for whom the patent system has been most important."

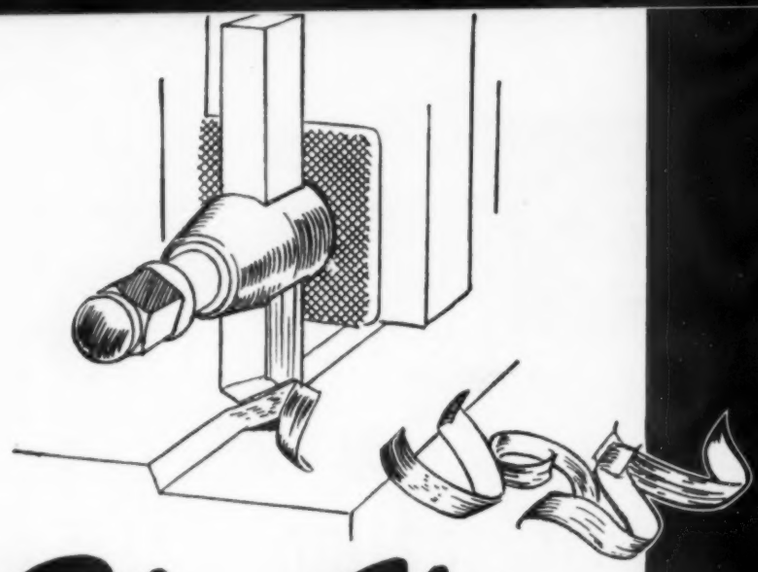
American ingenuity has been responsible for our industrial progress. Such ingenuity naturally results in inventions, some of which, like those pertaining to development of the automobile have revolutionized our living.

If we are to stay in the front rank technologically, we must encourage and foster new inventions. If the current decline continues, the patent situation deserves thorough study to find out what is responsible and corrective measures then should be taken.

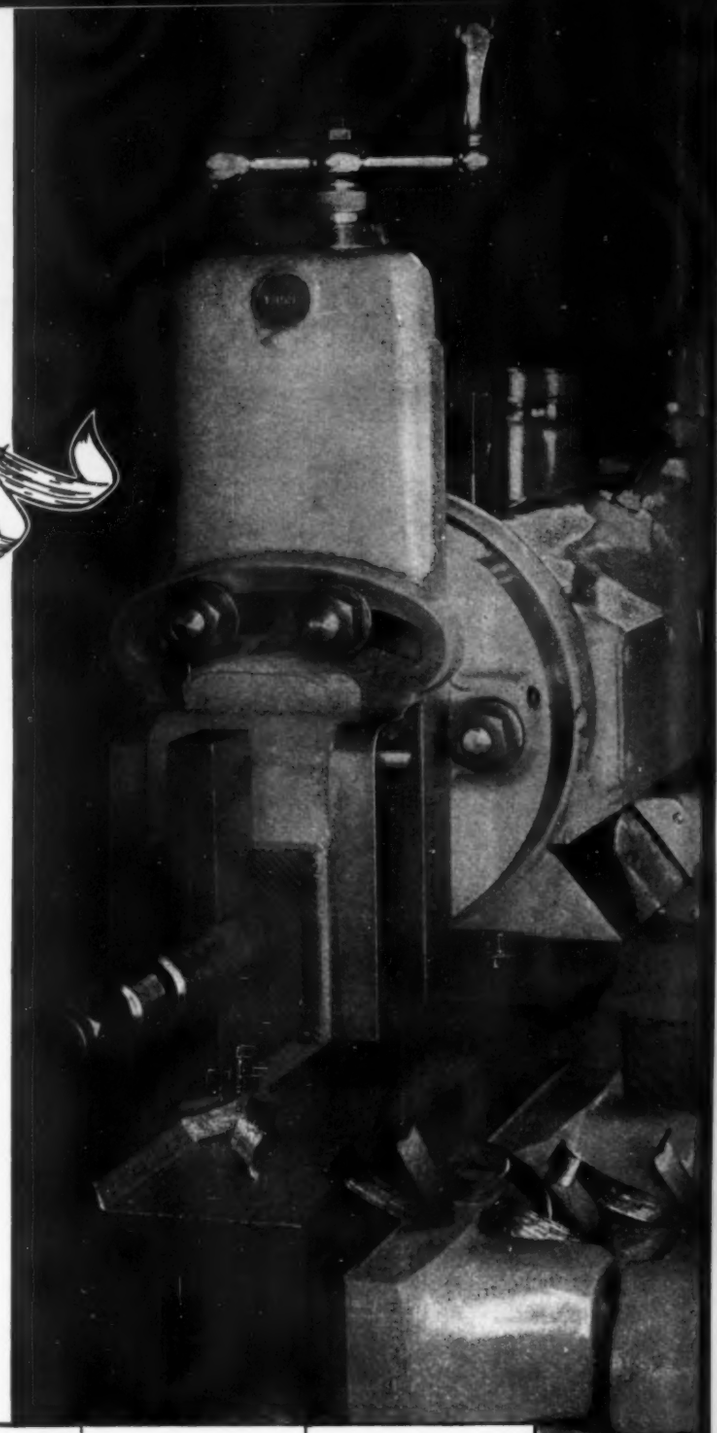
The fortunes of all of us in this country are too much tied to the nation's economic prosperity to allow technological stagnation to set in at home.

Burnham Finney

EDITOR



Blue Chips



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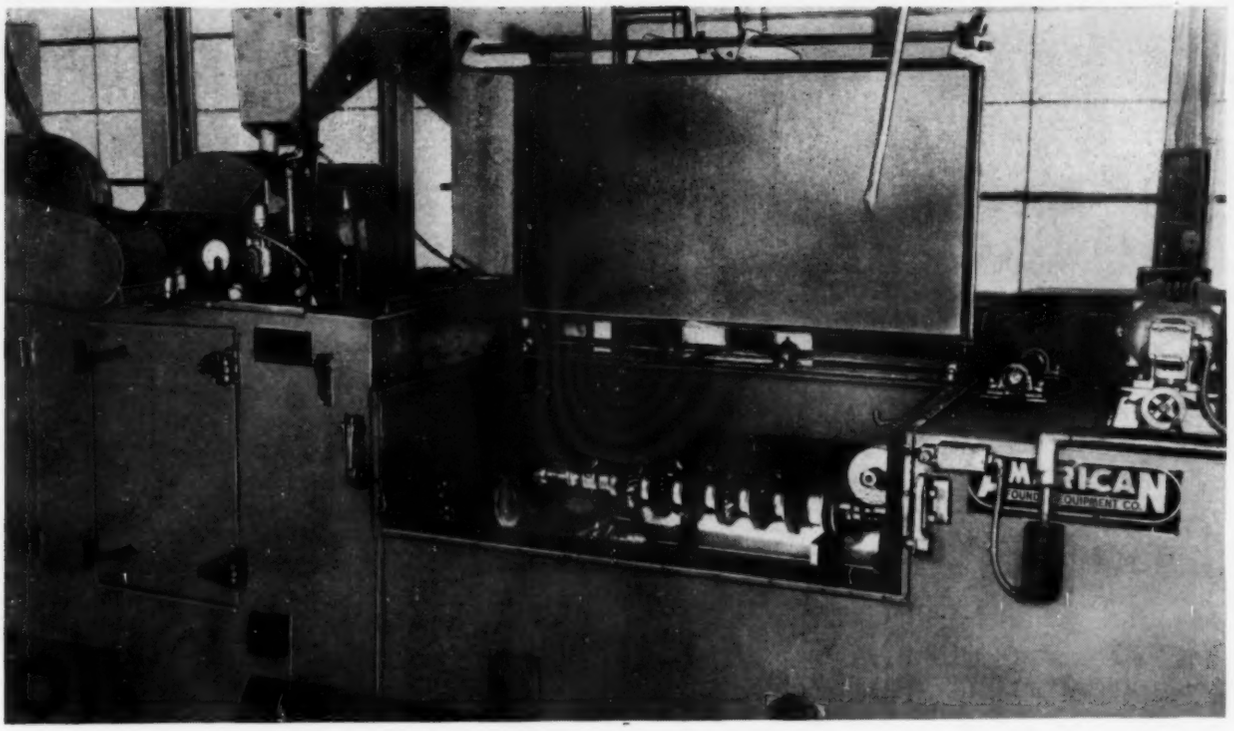


Special Wheelabrator cabinet holds six gears on a rotating arbor which carries them under the centrifugal wheel. Doors are electrically interlocked with wheel controls to prevent accidents

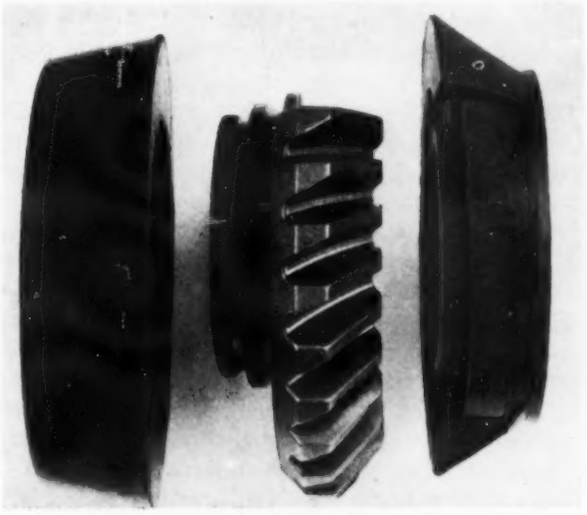
SELECTIVE SHOT PEENING EXTENDS FATIGUE LIFE

Stronger propeller hubs and operating units can be produced without undesirable weight increase

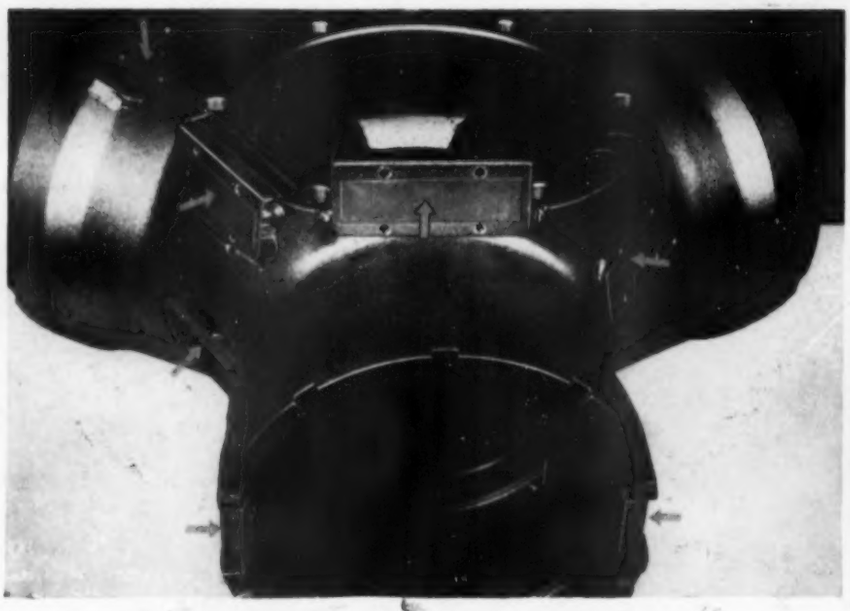
BY J. EPPRECHT, Production Engineer
H. W. EBERHARDT, Tool Engineer
Production Engineering Dept., Curtiss-Wright Corp., Caldwell, N. J.

STRESS requirements for metals have increased enormously during recent years, in keeping with industrial developments, and in the aviation industry in particular, the demands for high fatigue life have become extremely severe. The forces exerted on a propeller in action are among the highest known and create conditions to challenge the natural fatigue life of the materials from which it is built. These conditions, moreover, are complicated by the fact that weight is a most important factor, because the exceedingly high centrifugal forces multiply the effect of every extra ounce.

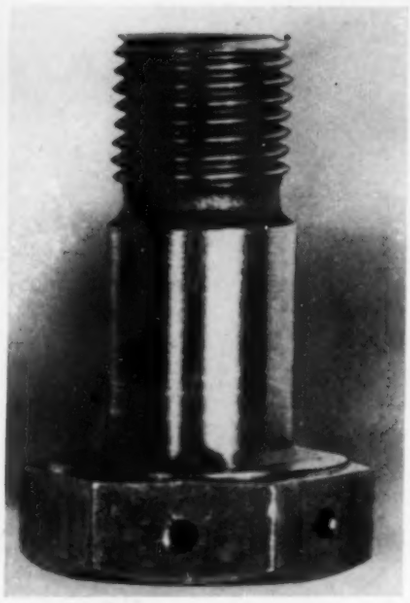
Faced with these circumstances Curtiss-Wright Propeller Division set up an extensive program for selective shot peening of highly stressed areas of critical parts and has been able to increase fatigue life 50 to 150% on many parts. Spiral bevel gears, fil-



Molded rubber masks protect all surfaces of the special interrupted spiral bevel gear except the teeth. Mottled effect produced by peening shows the type of surface produced by this process



Experimental setup for determining the extent of shot coverage on outside surfaces of propeller hubs. Almen specimens are attached to small pads welded to hub at critical locations, as shown by arrows, and are used to ascertain the uniformity of distribution



Shot peening thread undercuts will produce a notable increase in the fatigue life of bolts. Operation is performed in the gear peening machine

lets and sections of their adjacent surfaces, bolt undercuts, and buttress threads and their undercuts are among the items so treated.

Either air or centrifugal blasting may be used, depending on the circumstances, and no fixed rules can be laid down as to time of exposure, shot angle, shot flows, shot size or velocity. Each part must be handled experimentally until an optimum set of conditions has been established and these must be rigidly adhered to in production. It has been established, however, that round parts should be rotated while exposed to the blast, and that shot of known hardness should be used. The best results are now being obtained with Pittsburgh Crushed Steel Co. P-28 special heat-treated shot having a hardness of 55 Rockwell C.

Shot size and size maintenance has been a source of confusion through a probably prematurely established SAE standard. This specifies that shot be manufactured and graded to contain in any given quantity certain percentages of shot from various screens. No manufacturer is in a position to make shot to these specifications commercially available, and maintenance of these specifications in shot-peening operations would require bulky and complicated equipment. The practice at Curtiss is to disregard the SAE specifications and maintain an average shot size by removing worn smalls, broken halves, and dust by an air separator. The selection of shot size depends on the form of the part, the radii, surface finish and intensity required. For fillet work it has been established that the diameter of the shot should not be larger than the radius to be treated.

The correct intensity can be established only by fatigue tests. With each experimental part one or more Almen specimens are exposed, care being taken that these are so disposed in the fixture as to receive the same exposure as the part. The parts are then stress tested, and when optimum results have been obtained the Almen gage reading for the corresponding specimen is specified as the standard for that particular part. A reading of 0.012 in. is specified as an intensity of .012 A 2, which indicates a 0.012-in. arch and an Almen A specimen checked with an Almen No. 2 gage. Allowable variation on the A specimen is within 0.003 in., and this, added to the specification, gives a final specification reading of .012 A 2 $\pm$ 0.0015.

In regular production one or more specimens are attached to the fixture with each workpiece or group of pieces in the same load and these are forwarded to inspection. Peened pieces cannot be passed into the shop for further work or assembly until the corresponding specimen has been approved.

Areas of parts not to be peened are protected with special masks made from rubber of 60-70 Durometer or from hardened steel, as circumstances may demand. Rubber is preferred as its life is considerably greater than that of steel, and it does not contribute to breakdown of the shot. Nozzles for experimental work are made from hardened tool steel, but Norbide is preferred for production work.

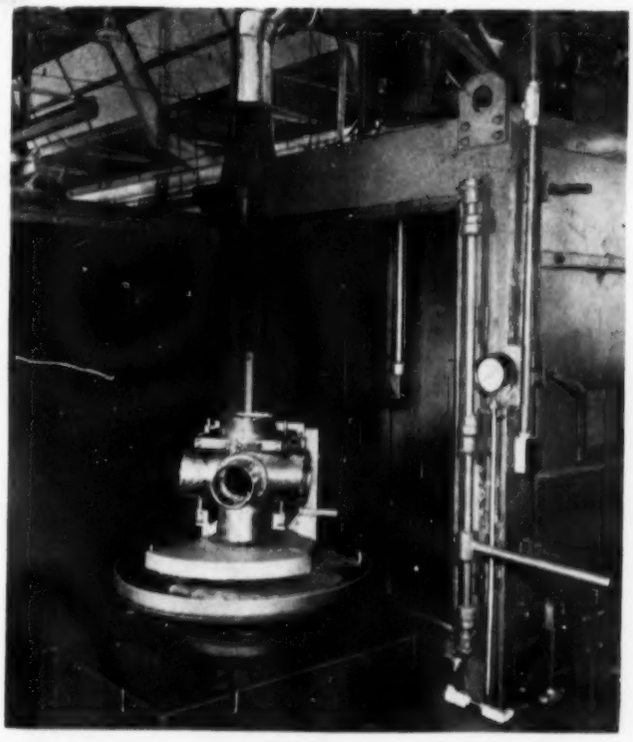
Spiral-bevel blade and power gears for propellers are shot peened on the tooth contours, tooth root, crown, and front and back faces. All other surfaces are protected by molded rubber masks. Six gears are mounted on an arbor with two Almen specimens, one on a horizontal and the other on a 45° plane, and the assembly is placed in a horizontal position on a sliding carriage in a special Wheelabrator. When the machine is started, the arbor rotates and the carriage

moves at a constant speed, regulated by a Reeves drive, toward and past the impeller wheel. As the first gear arrives at the correct position to receive the spray of shot, a gate, adjusted to the correct quantity of shot, opens and remains open until the last gear has passed the field of the shot. The arbor is then reversed and the machine completes its cycle to cover the other side of the gears.

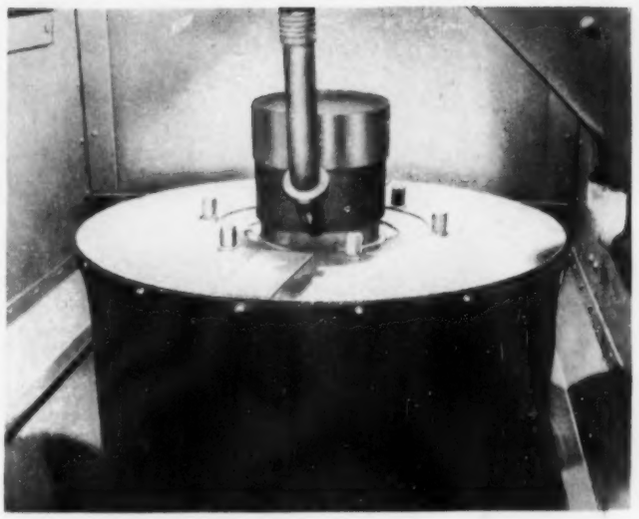
With the exception of inspection and corrosion proofing this is the final operation on the gears. Prior to shot peening they have been heat-treated to 60-62 Rockwell C, and the teeth have been ground. Tooth form and other gear dimensions are maintained within 0.0003 in.

The irregular outside surfaces of propeller hubs are peened on the same equipment, using a special rotary drive mounted on the carriage to cause the hub to rotate about the axis of each barrel in turn. All inside surfaces are shielded before the hub is mounted on the fixture, and the movement of the carriage and exposure to the shot is similar to that used in gear peening. A complete blend is obtained in the sections of the overlap on the hub body.

For blasting with compressed air, it was necessary to develop all the special equipment and methods, as no reference data were available. Experimental work was performed in a standard hand sandblast cabinet fitted with a power-operated rotary drive for the fixtures and a reciprocating drive for the shot lance. These drives were equipped with speed reducers to give constant, but different, speeds. The experimental setup provides a means of developing standards and gives a basis for the design of regular shot blasting equipment to be used in production.



Index fixture for peening threads inside hub barrels. Reciprocating lance in center of cabinet is power operated to insure even distribution of shot over all surfaces. Large rubber shield protects outside surfaces



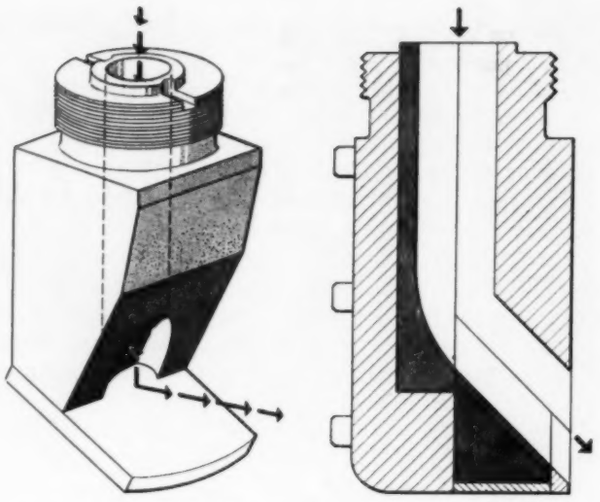
Rubber apron attached to steel plate shields the entire body of the propeller hub and a sleeve covers the hub extension while the fillet and adjacent area is peened. Shot is propelled by compressed air through an angular nozzle which is aimed directly at the fillet

Air blast is used in shot peening the fillet and adjacent sections at the point where the hub extension joins the main propeller hub. The work is mounted on a fixture with the extension end upward, and rotates at 40 rpm. A steel plate with a heavy rubber skirt passes over the hub extension and shields the body of the hub and the flange face, with the exception of the small face area to be peened. The upper portion of the extension is shielded with a rubber sleeve. The nozzle is held stationary at an angle to concentrate the blast on the small area involved.

Since it is not practicable to mount an Almen specimen with each part, an equipment performance test is made at the start of each shift and every four hours thereafter. For this check a special specimen-holding fixture is mounted on the rotary drive in place of the hub and is located to duplicate the position of the hub fillet. Serial numbers of the hubs peened in the period between tests are recorded, and those hubs are inspected with the specimen corresponding to that period. The hub is completely machined at the time of peening, the only subsequent operation being selective cadmium plating which extends over the peened area.

Internal buttress threads, undercuts and pilot diameters in propeller hub barrels are also shot peened with an air blast. The lower portion of the inside of the barrel is protected by a rubber cup to which is attached a funnel and short hose. This serves to discharge the spent shot through one of the other barrels into the base of the machine. The body is protected by a rubber cover similar to that used for fillet peening, and a rubber ring shields the outside top surface of the barrel being peened. The hub, with one barrel extending upward, is placed in an index fixture on a rotary table which can swing out of the cabinet for ease of loading. Fixed stops serve to locate the table in the cabinet so the shot nozzle

Rubber cup shields inside surfaces of hub and is held in place by steel snap ring. Funnel and rubber hose at bottom of cup permit spent shot to drain back through one of the other barrels into the base of the machine



Reflecting nozzle (left) carries an angular plate at the exit end to deflect shot and cause it to impinge on the lower, 15°, flank of buttress threads. Angular nozzle (right) is designed to direct the shot to the upper, 45°, flank of the thread and to the thread undercut and pilot diameters of propeller hub barrels

will be positioned in exactly the right place.

As the workpiece rotates, the lance carrying the nozzle moves up and down out of synchronization with the rotation to insure uniform distribution of shot. A specimen is mounted on the rim of the outside protector for checking purposes. Two separate nozzles are required for this operation. The first directs the shot downward at a 45° angle and is used for 2 min., the second is fashioned with a reflector plate to direct the shot upward to peen the lower faces of the threads, and is also used for 2 min.

The peening operation tends to produce a slight burr on the edges of the thread, and if the gage will not enter freely it has been found advisable to lap the threads lightly with a cast-iron lap. This operation is performed by the operator while the next piece is being peened.

For checking on nozzle wear and other variables, a performance check is made at the start of each shift and every four hours thereafter with a special specimen-holding fixture. On this fixture the various angles involved are represented, and any deviation shows on the specimens for the respective positions on the fixture.

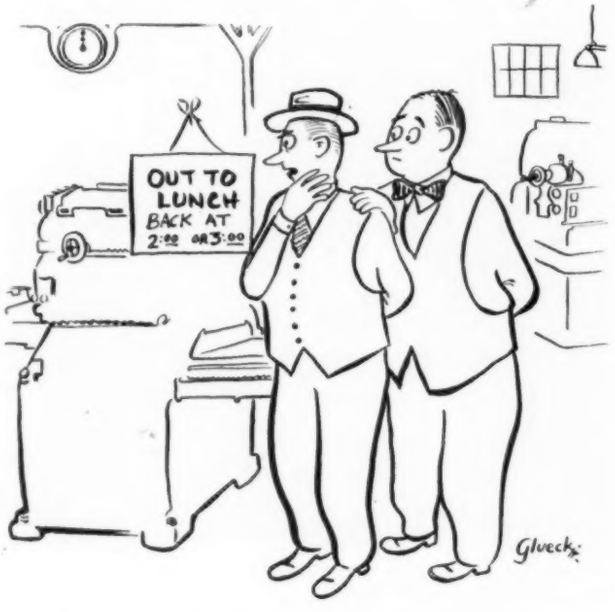
Considerable research is required to establish standards for each particular workpiece, but the increase in fatigue strength obtained at critical areas makes it as very worthwhile investment.

Tips FOR TOP SHOP MEN

254 Don't meddle with contemporaries' jobs. If you have comments or criticisms about the operation of other departments or staffs, make them to the boss, not to his—or your—subordinates. He may have a different perspective on the problem that will open your eyes.

255 The mailed fist is decidedly *not* the way to put across a new idea. If you're sure the idea is worthwhile, try it on some people who have the background to evaluate it. If they'll buy it, start asking the men most affected for their suggestions. Once a man feels he's contributed to a plan, he feels like a welsher if he doesn't support it.

256 It's one thing to display initiative, another to play a solo. Remember that even a soloist has a supporting orchestra that cooperates. Management must work the same way—one-man bands end up playing one-night stands.



"Mighty thoughtful of him to come back at all, what?"

Elasticity must be considered, even when a 20-ft. straightedge has a cross-section of 1x5 in. A light push at center will affect the instrument's straightness

How to Align Long Straightedges

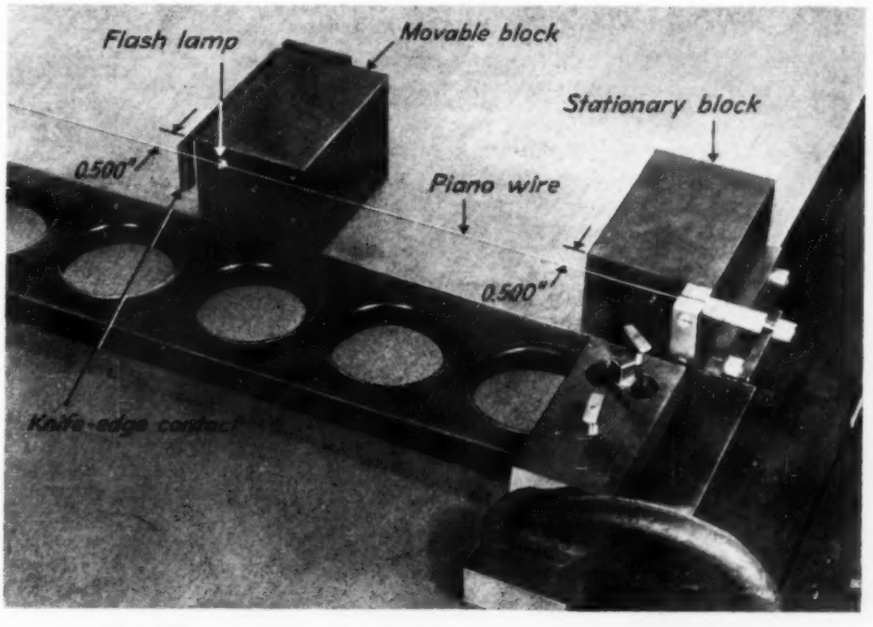
SHOP No. 1, Naval Gun Factory, Washington D.C., functions as a pilot plant for building gun mounts. Manufacturing methods and tooling are developed here while material is supplied to the fleet. If quantity orders are involved, private contractors usually apply the techniques developed.

When building large, accurate fixtures for planer- and boring-mill jobs, Shop No. 1 must often exercise ingenuity in making inspection setups. For example, Quarterman Luther E. Lee was not satisfied that his 20-ft. straightedge was actually straight when positioned on the shop's large surface plate. So he made the illustrated equipment to check the alignment of the straightedge each time it is used. He found that inspectors might unknowingly create bowing of as much as 0.0010 in. at the center of the straightedge by a light push, even though the tool has a cross-section of 1x5 in.

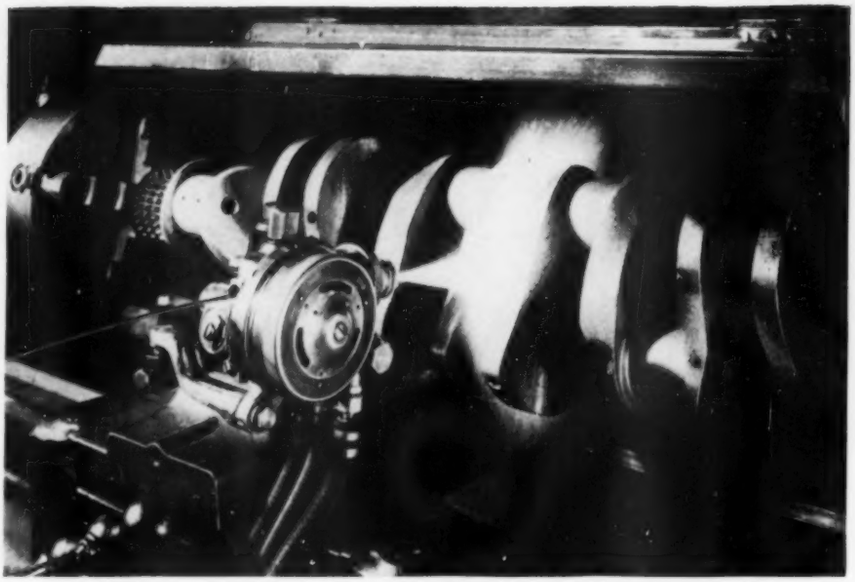
The straightedge is checked by making electrical contact with a piano wire. The wire is stretched between two reference blocks fastened at opposite ends of the surface plate. And brackets position the wire exactly 0.500 in. from the faces of the stationary blocks.

A movable block is fitted with a knife-edge contact that protrudes exactly 0.500 in. from the reference faces. Contact of the knife edge with the wire causes a flashlight lamp in the block to light.

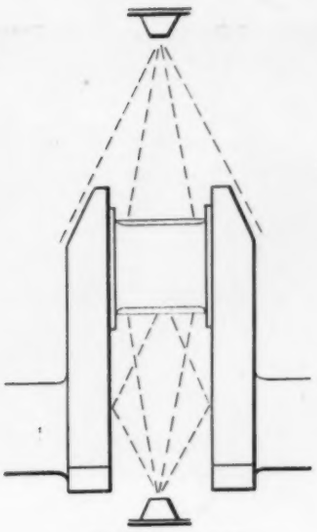
To check the straightedge its ends are clamped to the table so that one edge is in contact with the reference surfaces of the stationary blocks. Then the movable block is brought to bear against the same edge and moved slowly along. Meanwhile, the straightedge is prodded so that electrical contact is just made and the lamp flashes. The entire job takes only about ½ hr., and there is definite assurance that fixture elements set up in reference to the straightedge are in nearly perfect alignment.



Bowing and waviness are corrected by establishing parallelism between the side of the straightedge and the piano wire, using an electrical-contact method



Crankshaft bearing surface is reconditioned with a sprayed coating of 0.80 carbon steel. Wire, fed into the gun automatically, is melted continuously in a gas flame under pressure, is atomized and blown from the nozzle by compressed air. The worn surface is ground undersize and roughened before spraying and finish ground to size after the operation



Crank throws build up faster on the inside than on the outside because molten particles deflect onto the bearing surface on the inside of the throw, but pass into the air on the outside. Diagram outlines paths of metal at both crank positions

METALLIZING FAILURES TO AVOID

Proper surface preparation

for good adhesion of the coating to the work

is essential to long service life

BY JOHN E. WAKEFIELD, METALLIZING ENGINEERING COMPANY, INC.

MORE THAN 8000 companies are rebuilding worn or undersize machine parts with sprayed metals. Yet, despite the use of metallizing in this country for almost twenty years, there is still a certain amount of skepticism about the process.

This stems partly from lack of knowledge. Sprayed metals differ from other forms. Their structure and physical properties are not comparable to those of the familiar metals, and to many, it is not clear what holds the sprayed material to the base.

Another reason for skepticism is the varied success attained in application. Some companies have had excellent results from metallizing, others have had poor experiences. Occasionally, coatings have cracked or broken loose entirely from the part.

Neither of these two reasons for doubt should continue to exist. Lack of knowledge can be overcome and so can unsatisfactory performance.

To avoid metallizing failures, there are two things to do. First, understand the limitations of the process and apply it where it can reasonably be expected to stand the conditions. Second, be sure that the surface preparation is done correctly and is suitable for the operating requirements.

Since its tensile strength, bond strength and particle adhesion are all on the low side, there are three types of jobs on which the process should not be attempted.

One is a bearing race with balls or rollers operating on the sprayed coating. The second is where threads are to be cut in the deposit. Sprayed metal will not stand the strain to which most threads are subjected. For the same reason, it cannot be used on gear teeth. The third application to avoid is one involving impact, as in punches and dies.

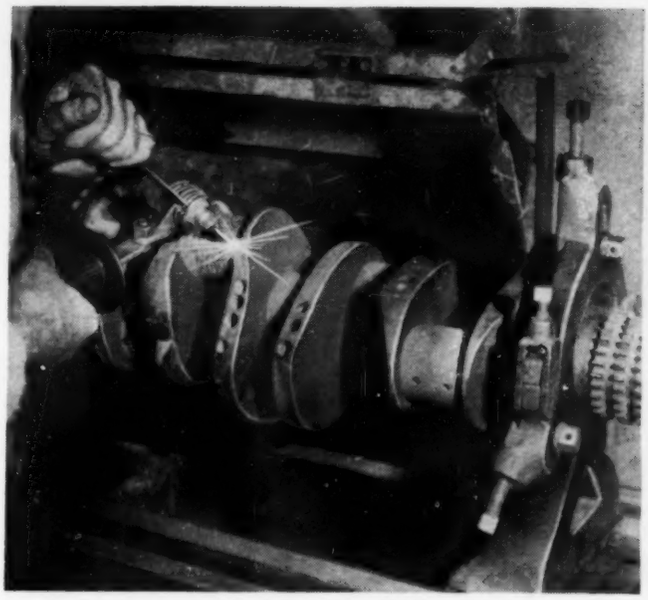
The second point, proper preparation, is extremely important. Of 20 or 30 failures studied over a 12-year period, 90% were caused by improper treatment of the surface to be coated.

Several typical experiences will be described to illustrate several causes of failure and the appropriate solution.

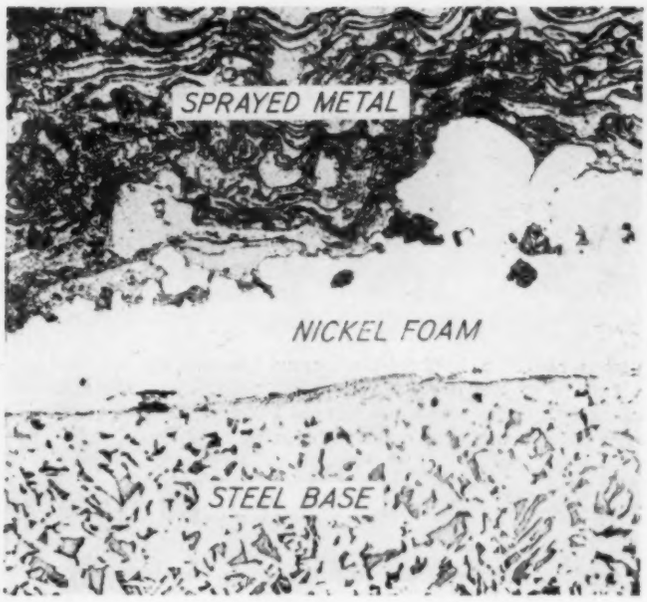
Crankshaft

An interesting problem arose over the crankshaft of an interstate bus engine. One throw of the crank was metallized. Placed back in operation, the coating failed after less than 400 miles.

Examination revealed that the sprayed metal had cracked across the throw and had come loose from



Surface preparation with an electric arc and a special nickel electrode is shown. Pieces, torn from the electrode as it is moved along, are fused to the bearing surface



Nickel foam (center, white section) contains many hooks and irregularities that make a good bonding surface. Bottom layer is the base and top layer is the sprayed steel

the bearing surface except for a narrow area near the oil hole. Thus, the steel coating was simply a loose ring, attached at this one point.

It was also noted that the shell was 0.016 in. thick at one point and 0.035 in. thick at a point directly opposite. This eccentricity in the coating meant an eccentric bearing surface. But what caused the coating to be eccentric?

Experiments showed that material sprayed on crank throws is always a little out of round before grinding. This is not true on mains, just throws, and results from the stream of molten particles flaring into a cone after leaving the gun. On the inside of the throw, the globules in the outer part of the cone ricochet off the cheeks and onto the surface being sprayed. On the outside, particles pass off into the air. Hence, the inside is always built up faster than the outside. The sketch illustrates this action.

Grinding, of course, should produce a concentric surface. This shaft, however, was set in V-blocks and the throw was centered for the grinding operation from the coating itself. The sprayed throw was 0.018 to 0.025 in. out of round and the eccentricity was preserved in the final surface.

Two things were done to prevent a recurrence of this failure. One was to set the throw on its proper center for grinding. The other was to grind the throw enough undersize before metallizing to allow a finished coating thickness of 0.050 in. on the radius. A coating only 0.016 in., as this was originally, could hardly be expected to stand even the normal load on the crank.

This procedure has been followed for the past 12 years and there has been no further trouble with metallized cranks.

Crankshaft main bearings are no great problem. On throws, however, there are three major considerations. First, because of relatively high loads, a substantial coating of either 0.80 carbon or high chrome-medium carbon stainless steel should be applied. Both of these metals are hard and resistant to wear. 0.040 in. thickness (or more) on the radius is preferred. Second, the surface must be perfectly clean before spraying. many people do not realize that metallizing, like any other process that involves the bonding of metals, demands absolute cleanliness. Third, the surface must be roughened properly.

Where it can be done, threading is a good initial roughening step, because it exposes clean bright metal. However, the surface should be roughened further, by any of several methods.

One involves the use of a transformer of the proper current characteristics. Special nickel electrodes are brushed over the threads, leaving what amounts to a frozen foam, with many hooks and anchors. The photomicrograph clearly shows the irregularity of the nickel layer. This combination of threads and electrode deposit produces an excellent bond.

When the surface is too hard for threading, the electrical method may be used alone. Care should be exercised to see that the deposit covers at least 90% to 95% of the area to be sprayed.

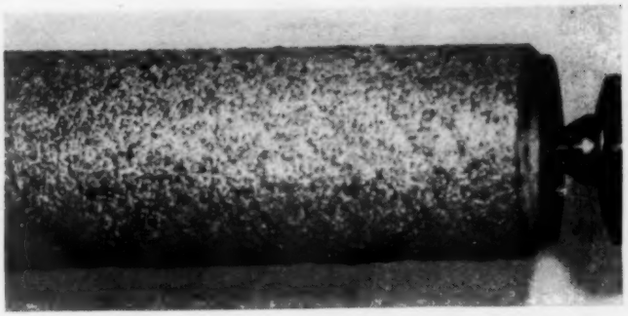
Clean surfaces, properly roughened, with a substantial coating of a hard, wear-resistant steel, will prevent failures on crank throws that are correctly ground.

Compressor Piston Rod

Another failure was on a hydrogen-nitrogen compressor piston rod. This part operated at the fifth compression stage and was under pressure of approximately 1800 psi.

After some service, the metallized section developed bad longitudinal cracks in the central area. These are visible in the photograph. In one small area, the coating was off entirely and revealed careful roughening underneath.

Piston rod of a hydrogen-nitrogen compressor illustrates a failure caused by gases forced through the metallized coating by operating pressures. Thicker coatings, properly sealed, will eliminate failures of this type



Nickel deposit should cover 95% of the area to insure adherence of the coating. Adherence is not caused by alloying but by a mechanical interlocking of the coating and the rough surface

Preparation, then, was not the cause of the trouble.

One or two similar failures had been noted on hydraulic press rams under pressures of 2000 psi. or more. Sprayed metal sections are porous when relatively thin and high pressures can sometimes force liquids or gases through them. These substances are trapped under the coating and as the area passes the packing, force their way out, cracking the sprayed material. Undoubtedly, this was the cause of the trouble.

To solve such problems two things are done. One is to increase the thickness of the coating. On a 4-in. dia. it is advisable to undercut the area to be metallized at least 0.030 in. on the radius in addition to the amount of normal wear. Where this is done, a respectable thickness of sprayed metal will remain after maximum allowable wear.

The second point is to seal the coating. This can be done by saturating it with raw tung oil, mixed with a 5% solution of cobalt liquid drier. The oil should be applied, by painting or dipping, while the part is still warm, and before finishing. Fill the coating completely and let it dry thoroughly. Then machine or grind.

Treated in this way several hundred similar parts have operated successfully for several years, with some subjected to as much as 4000 psi. When the cause of failure is too thin coatings for the porosity of the sprayed metal, the solution is heavier coatings and sealing as described.

A tailshaft similar to the one pictured had been metallized with monel to protect it from corrosion between bearing bronzes. The next time the ship was drydocked, it was found that the monel had come away entirely from about half the area coated. Corrosion had occurred on the exposed steel shaft, so it was impossible to tell from that section what form of preparation was used.

When some of the remaining monel was chipped off, it was found that the electrical method had been used, but the deposit covered only about 10% of the surface. There was nothing to which the monel could bond properly on most of the shaft.

Where the nickel deposit covers 95% of the area, no failures occur. Many other shafts have been done correctly and are still in operation.

Stamping Press Shaft

Another informative study was on the failure of a backshaft in a stamping press. The bearing surface had been coated with 0.80 carbon steel to restore standard size. After only three days in service, the steel had cracked and come away entirely.

The shaft was running in a roller bearing with the rollers themselves operating directly on the sprayed coating. It is well known that balls or rollers tend to elongate the surface on which they run. The sprayed section, which is in effect a sleeve shrunk onto the shaft surface, was only 0.0625 in. thick. Because it was thin, and because the particle adhesion of sprayed metals is relatively low, the coating could not stand the tendency to elongate.

The shaft was remetallized and reassembled in a straight bronze bearing. Periodic checks have indicated that performance is satisfactory, and after seven years, the unit is still operating without difficulty. The cause of the original failure, more than anything else, was improper application. Low particle adhesion cannot be expected to stand such severe action as occurs in that type of bearing.

Reciprocating Shaft

One more case is interesting. A reciprocating shaft, similar to that shown, was metallized with high chrome-medium carbon steel. After a relatively short time in operation, cracks showed up in the center, but unlike those on the compressor piston rod, these extended around the shaft. One crack, at almost the exact center of the area was the worst. On each side were successive cracks diminishing in size progressively from the center.

A study of operating conditions revealed that the greatest strain on the shaft was applied by the packing at the center. This diminished progressivley toward the ends. Thus, the tendency was to pull the coating away from the center in both directions.

Next the preparation was investigated. The rod had been undercut and dovetailed at each end properly. The area to be sprayed had then been blasted with G-16 angular steel grit. It was obvious that a stronger bond was needed at the center of the rod.

Another similar rod was selected for metallizing. Preparation was identical, except that a series of twelve straight grooves were cut around the center of the shaft before blasting. These were cut with a square-nosed tool, with corners stoned to prevent fracture lines and were spaced to allow about 1/16 in. between them. Each groove was 0.050 in. wide and 0.025 in. deep. Again metallizing was done with high-chrome, medium-carbon stainless steel. The shaft was finished by wet grinding.

A check after three months of operation showed no cracks. Since that time, many other rods have been processed with grooves at the center and all have performed satisfactorily.

The cause of the original failure was inadequate preparation for the conditions of operation. The solution was to select a method of preparation that would withstand the additional strain at the center section.

Only Two Real Causes

While no two failures of sprayed metal coatings are identical, causes fall into a definite pattern. In fact, only two real reasons exist. One is lack of understanding, as in the case of the crankshaft and the stamping-press shaft. The other is improper preparation. This in itself can come from lack of understanding, but is noted separately here because it can also be the result of careless workmanship. Both the tailshaft and reciprocating rod illustrate poor preparation.

Metallizing is no cure-all, of course. Like any other process, it has its limitations. Because of the characteristics of sprayed metals there are three types of jobs on which metallizing should not be attempted: (1) where balls or rollers operate on the coating; (2) where threads are to be cut in the sprayed material, and on gear teeth; (3) where there is impact.

Many mechanical parts are not operated in conditions comparable to the three above. Bearing surfaces should not have to stand impact; they're not strained like threads; and tensile strength usually is not important on the outer surface.

Actually, there is no record of a metallized shaft breaking, even though some large diameters have been built up as much as ½ in. on the radius. Small diameters should never wear that much in the first place. Once the limitations of metallizing are fully understood and related to the job to be done, the process will not be applied to parts on which it will not stand up.

Advantages of Metallizing

On the other side of the ledger, metallizing has several advantages. Its porosity, for example, is an advantage on bearing surfaces. It permits oil absorption and reduced friction; they, in turn, mean longer wear.

The process is versatile. Because any metal may be sprayed onto any surface which can be prepared properly, it is often possible to improve parts as well as save them.

Metallizing is a low-heat process. Since parts are seldom heated above 250F., the danger of distortion and a consequent straightening operation is eliminated.

Probably the largest single advantage, however, is its speed. Some modern guns spray as much as 21 lb. an hour of stainless or high-carbon steel. That means faster repair, lower cost, and less outage of production machinery.

Failures of metallizing can be avoided in large measure. But we must learn to use the process properly. If failures do occur, study them. Find the cause and work out a solution. Let's learn from our own mistakes.

Tailshaft of a ship is sprayed with monel to protect the steel surface from corrosion

Reciprocating shafts are in three stages of completion. One at left is roughened; center, sprayed; right, ground

HOW TO PREVENT

Gear Grinding Troubles...II

Causes of cracking and burning in grinding can be determined by several methods and should be eliminated at their source

BY L. P. TARASOV
Norton Company Research Laboratories

THE END product of all trouble shooting is to correct the trouble in the most economical fashion. When the quality of a ground surface is under consideration an appreciable number of factors may have to be taken into account.

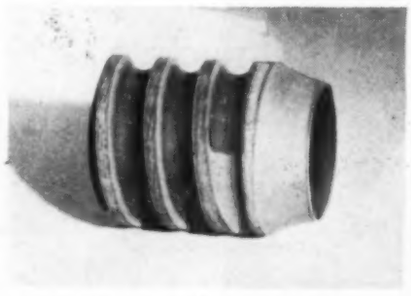
First of all, it is necessary to decide whether the trouble is real or imaginary. The presence of burn or even of surface cracks in a ground surface is not automatically harmful. An injurious condition is present only when experience or test has shown that the service life of the part in question is adversely affected by the defect.

On the basis of experience, it can be concluded that both cracks and burns are harmful when found in the teeth of gears subjected to severe usage, as in aircraft engines. Surface cracks, even though very fine, propagate readily with almost immediate failure of the teeth. Burn, commonly occurring most strongly in the roots of the teeth, is just as bad in such cases since it is associated with very high stresses in its vicinity, from which cracks are easily generated upon the external application of high alternating stresses in actual service.

In less highly stressed gears, a similar degree of burning may have no noticeable effect upon their useful life. Cracks are still likely to be injurious; however, instances are known where gears in which the teeth were cracked slightly lasted longer than those with no cracks at all. In these cases, the location of the cracks was such that they could not propagate further under the applied stresses.

Another example of harmless surface cracking involved slightly cracked cemented carbide tools that have lasted as long as their uncracked counterparts, the reason being the same as that just given for gears. A third example is furnished by master cams used in cam grinding machines. Here experience has shown that a few tiny cracks found only by magnetic particle inspection do not have any effect on the life of the master cams since practically no stress is applied to them.

In the instances mentioned thus far, burn was harmful primarily because of the associated stress. It can also be harmful in itself. An outstanding example is a burned cutting edge of a tool, where the resulting soft skin leads to poor tool life. Excessive wear and premature failure can also occur when a hardened surface which is intended to be used in moving contact with another has been softened as a result of too much heat in the grinding operation.



Case hardened worm shows severe burning and cracking in the thread roots. Trouble was traced to excessive stock left after hobbing operation

Surface cracks sometimes found in the hubs or faces of gears are likely to be harmful if these are contacting surfaces, but not otherwise. Such cracks are also cause for rejection when found in worm threads since the soft gears, such as bronze, with which they are used, may become scored by the sharp edges of the minute cracks or by the debris that is likely to gradually accumulate in them.

Locating Source of Injury

If there is reason to suspect that burn or cracking is injurious in a given instance, the first step is to determine the real source of the trouble. Grinding can always be conveniently blamed since it is the immediate apparent cause. However, this is a shortsighted policy since it can be a very expensive proposition to eliminate the trouble by slowing down the grinding operation, as is generally possible, when a little more attention to the prior processing steps would have cured the trouble just as well.

When a hardened steel is exceptionally brittle from the standpoint of grinding, it often happens that it becomes cracked during grinding without there being any detectable burn. Or even if there is some burn, the cracks may be primarily due to the extreme sensitivity of the steel. It may be difficult to analyze the problem correctly in such a case, although

Hardened steel worm burned in thread grinding, as indicated by the dark areas developed by etching

Opposite side of worm shows only faint traces of burn and indicates that grinding at badly burned side was faulty

metallographic and hardness studies may furnish a clue. In general, sensitivity should be suspected when surface cracks are found in conjunction with less than a moderate degree of burning.

The presence of pronounced burn does not necessarily imply that grinding was basically at fault. Dimensional irregularities resulting from heat-treatment distortion or from unsatisfactory machining practice, can lead to very strong burn patterns. This type of burn can be eliminated either by seeing to it that the part is within closer limits when it is ready for grinding, or by modifying the grinding operation to take into account the existence of such irregularities.

The nature of the burn pattern may help in locating the source of the trouble even when the grinding operation itself is at fault. For example, a case-hardened worm was found to be badly burned on one side of the thread but not on the opposite, where only a few faint indications of softening could be found after etching. Grinding in one traverse direction evidently forced the wheel against the side of the thread more severely than grinding in the opposite direction. Either the mechanical condition of the machine or differences in dressing the two sides of the wheel may have been responsible. Additional experimental work would be necessary to decide authoritatively between these two possible causes.

Possible Remedies

Once the causes of surface injury have been determined as well as possible, it becomes necessary to decide what changes to make to eliminate the harmful effect. An improvement in the grinding conditions is frequently the easiest step to take even when some other factor may be primarily responsible. This is especially true when a batch of parts has been processed unsatisfactorily and is ready for grinding. In such instances, the only way to make the parts pass inspection after grinding may be to grind much more carefully than would normally be warranted. This, however, is essentially an immediate solution of the problem and may be a highly uneconomical procedure justifiable only from the standpoint of salvage.

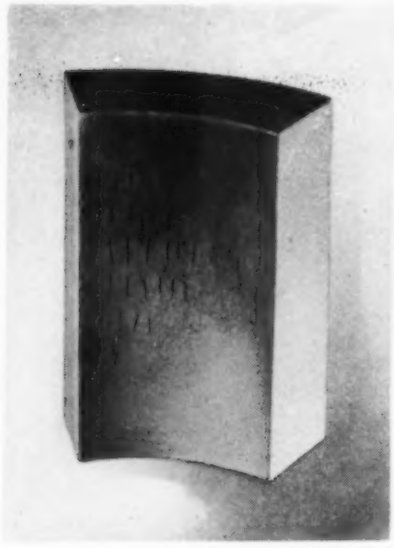
The long-range solution to the same problem may be quite different, since it should be based on the least overall cost per finished part passing inspection. Such a remedy is needed when a part is to continue to be made in large quantities.

A number of specific solutions have already been indicated in the discussion of the various possible causes of injury. Two others are worth mentioning at this point. When tiny surface cracks are found to occur near a sharp edge, as in a gear tooth, it has been found helpful to chamfer the edge before it is ground. There is then less likelihood of concentrating a dangerous amount of grinding heat along the edge of the surface since there is more underlying metal into which the heat can rapidly dissipate.

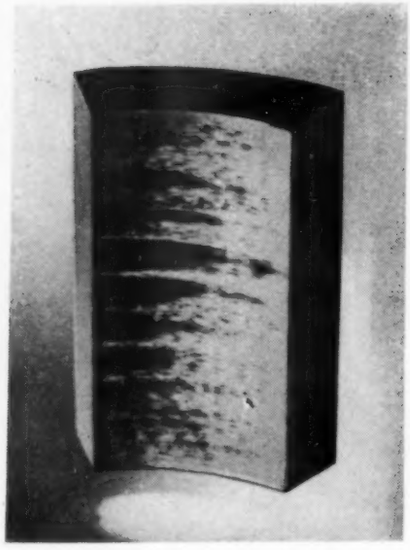
Stress relief after grinding is another way of overcoming possible injury. If a part is stressed severely in grinding it may crack later, either on the shelf or in service. This embarrassment can often be avoided by stress relieving for one or more hours at about 350 F. This low-temperature stress relief generally decreases the surface stresses to such a point that they are no longer able to develop into cracks.

Examples of Trouble Shooting

On one occasion, a large number of very fine, short cracks were observed in the internally ground surface of a hardened steel ring. There was no trace of visible burn in the ring, but etching in the usual manner to reveal burn marks that had been cleaned off resulted in pronounced burn streaks. The darkest of these were seen to coincide exactly with the cracks. This exact correspondence and the nature of the pattern proved beyond a doubt that the grinding had to be corrected in the direction of lesser



Magnaflux indications on a portion of an internally ground hardened steel ring shows a system of fine parallel cracks running along the surface



Etching the part shown in the preceding illustration reveals severe burn marks which coincide with the fine cracks and indicate improper grinding

severity, and that the heat treatment was not at fault, as was first claimed. Extending beyond the very dark areas were numerous individual burn marks. Here the grinding was not nearly as severe and as a result the surface was burned only slightly but did not become cracked.

Cracked Steel Worms

A problem that turned out to be somewhat more complicated to solve involved case-hardened worms about 1 in. in diameter. These were hobbed, carburized, hardened and ground. From time to time certain lots were found, after grinding, to be cracked in the thread roots. Both grinding and heat treatment were suspected but the source of the trouble could not be located. Changes in heat-treating or grinding conditions would apparently cause the trouble to disappear, but then the cracks would come back again in some of the later lots.

When a portion of a cracked worm was etched to see if it had been burned, it was found that the root and sides of the thread became very dark, thus indicating severe burn. In addition, small white spots were observed, primarily near the point at which the thread first began to be ground. They were distributed in a regular chatter pattern and were caused by localized rehardening. On the other hand, a worm that was crack-free as shown by the Magnaflux test, did not darken upon etching. This appeared to point to improper grinding as the cause of cracking.

The grinding operation was looked into more carefully and it was found that excessive stock left from the hobbing operation had to be removed from some of the worms, and it was these that were burned and cracked. To avoid excessive stock removal, it was decided to introduce an extra grinding operation directly after hobbing. In this way, only a comparatively small and uniform amount of stock had to be removed in the final grinding operation, when the steel was hard and susceptible to cracking. No further trouble was encountered once it was recognized that the worms had to be prepared to closer limits before they were ground in the hardened condition.

In another plant, cracking was encountered when the cams on carburized and hardened camshafts were ground. Here the problem was complicated by the fact that both the grinding and heat-treating conditions needed improvement. Cracking still occurred when improvements were made in only one of the factors. The main difficulty with the grinding was that the available wheels were too hard and production could not be interrupted to wait for the delivery of softer wheels. A partial step in the right direction was made by going to a somewhat lower wheel speed than normal, as this made the wheel break down more readily and thus remain sharper. The rate of infeed was decreased and this helped by lowering the rate at which heat was being generated, but it meant fewer cams per hour. Increasing the work speed would have restored the rate of production without causing any difficulty from a higher rate of heat generation because the heat would have been spread out over a greater work area so that the surface temperature would have remained about the same as at lower work speed. However, it was not possible to make this change because then the cam would not have been ground with the required accuracy.

Trouble with Iron Carbide

Metallographic examination of the microstructure of the carburized layer showed a fairly heavy network of iron carbide. A change in the carburizing conditions was not feasible, since this would have involved considerable investigation, for which time was lacking. Instead, the steel was no longer quenched directly from the carburizing furnace but was permitted to cool in air so that the case remained soft. The outer portion of the carburized layer, which contained the excess carbon, was ground off without any particular trouble. The cams were then hardened and the subsequent grinding operations did not result in any cracking of the surface.

Another remedy for improper carburization, which is sometimes very effective in eliminating cracks in grinding, is to lower the hardness somewhat. For example, certain lots of worms which were case-hardened to Rockwell C55 or better, cracked in grinding. The sensitivity was traced to an excessive carbon content in the outer portion of the case, but nothing could be done about it since the worms were heat treated outside the plant. The solution was to drop the hardness to C50, which decreased the sensi-

tivity enough so that no further cracking occurred. Since the worms ran against bronze gears, there was no real necessity of having the original higher hardness; the softer worms lasted just as long.

Surface Quality of Gears

The subject of surface quality has many ramifications, some of which have been discussed in considerable detail. To put the story in proper perspective, it is desirable to review briefly, from the standpoint of the gear manufacturing industry, the most important factors affecting the quality of ground surfaces.

First of all, the type of steel must be considered. Carburized and hardened steels are at present the chief source of difficulty in grinding. When the carburizing practice is poor, the hardened case becomes extremely sensitive and may crack even when the grinding operation is carried out with considerable care. The remedy is to get rid of the unsatisfactory microstructure responsible for the sensitivity. When this is done, experience has shown that the cracking problem almost invariably disappears.

There is no trouble from cracking during grinding when the gears are made from direct hardening alloy steels, such as are used for machine tools. These steels, when hardened and tempered in normal fashion, are not at all sensitive. High-speed steels used to be troublesome, but with the general acceptance of multiple tempering to insure complete hardening, these steels are no longer considered difficult to grind. Gear cutter manufacturers report no trouble from surface cracking of high-speed steel cutters. Here again, the problem of eliminating cracks was successfully solved by improving the heat treatment and resultant microstructure.

The effect of burn on the quality of a ground gear depends on the conditions under which the finished part is to be used. Burn in the roots of carburized gears may be a cause for their rejection since experience has shown that such gears are likely to fail prematurely. In direct hardening alloy steels, however, a light or moderate burn is usually believed to be of no practical significance since the gears are softer and are used under moderate loads. As for high speed steel cutters, the usual criterion of a satisfactory grind is the absence of visible burn; if the burn can be revealed only by etching, the belief is prevalent that not enough softening took place to be harmful to the cutter life, but this belief is beginning to be questioned by some users.

The type of grinding fluid that should be used depends on the steel and on the operation. Straight grinding oils are needed for grinding carburized and hardened gear teeth, while soluble oils diluted to the proper concentration have been found satisfactory for grinding direct hardened alloy-steel gear teeth, as well as other parts of gears regardless of what steel they are made from. Hardened worms are always ground with regular thread-grinding oils.

Form grinding of gear teeth involves much broader contact than does generative grinding and for that reason greater care has to be taken in form grinding to avoid burning or checking the teeth.

The simplest way to avoid injurious effects is to take plenty of time. There are some plants that never have any trouble from cracking or burning because their product is expensive enough so they are in a position to put high quality before high production. In most cases, however, production costs have to be watched carefully, but this does not mean that the quality of the ground surfaces has necessarily to be lower.

Many Factors Involved

To get high quality at high production rates requires that constant attention be paid to all the factors capable of causing trouble. These factors, which include not only grinding but many of the prior processing operations such as machining and heat treatment, are now fairly well known. When trouble does occur, its source can be located by methods similar to those described in connection with the trouble shooting examples; skilled metallurgical assistance, however, may be necessary in the more difficult cases.

It must be kept in mind that there is always a limit to the rate at which metal can be ground off without injury to the work. There is no advantage in exceeding a safe rate to meet a production goal and then to have the finished parts rejected for real defects. Production should be thought of in terms of the number of parts passing inspection tests, based upon performance in use, and not on the number produced at the machine. The aim should be to find the maximum production rate that does not injure the work pieces from the standpoint of their service life, and that keeps the cost per piece to an irreducible minimum.

The big problem now facing those involved in grinding hardened steel parts is to determine just where to draw the line on defects in each particular part so as to eliminate only those that are harmful in service and thus avoid raising costs unnecessarily.

Chronocyclegraph Sells Motion Study

Miss Anne G. Shaw, Consultant in Training and Motion Study (Cheshire, England), speaking at the Third Annual Time and Motion Study Conference, stressed the worth of the chronocyclegraph in convincing people of the value of motion study.

This photographic record of motion patterns, she pointed out, is "the perfect means of demonstrating motion study to the wider circle of supervisors, worker's representatives, and management in general. Only the chonocyclegraph can really put onto paper the subtle difference between a good movement and a bad one." Thus, it is also well suited to training operators themselves.

Miss Shaw also brought out to the conference, held by the Society for the Advancement of Management in conjunction with the Management Division of the American Society of Mechanical Engineers, the importance of the procedure in methods improvement work. The chronocyclegraph shows up awkwardness in motions and where an improvement has been made shows proof that the change was correct.

Conveyor Furnace Anneals Bimetal Strips

Bimetal is made to curl when it is heated.

This is fine in instruments, not so good during production.

A unique furnace design solved the annealing problem

BY C. F. ALBAN, Chief Engineer W. M. Chace Co.

PRECISION thermostatic bimetals give trouble in the process annealing between cold-rolling operations. Chace thermostatic bimetals are laminated materials of two or three layers of different alloys selected to give definite physical properties. These thermostatic bimetals are fabricated into actuating elements for temperature responsive devices. In short, each bimetal element becomes an instrument part.

The fundamental property of thermostatic bimetal is its ability to change curvature with temperature change. A definite torque is thus produced with a temperature change. Many modern devices use this property of changing heat to mechanical work to actuate them.

The precision to which this material can be produced depends on many factors. One of these is the uniformity of annealing between cold-rolling operations. During cold rolling it is of utmost importance to maintain a uniform thickness along the strip as well as across it. This control of the thickness tolerances must start with the heavy sheets and be maintained right down to the last cold pass. The material is then slit to the specified width, straightened, and fabricated into actuating elements.

This bending property complicates the problem of annealing. The strips, following this fundamental property, change curvature during the heating and cooling cycles. The development of suitable annealing equipment must include the following factors:

1. Bright finish
2. Uniform anneal
3. Mechanical handling

We are mostly concerned here with the process annealing of sizes from 0.080 to 0.250 in. thick. The width may vary from 3 to 6 in. depending upon the material. The alloys to be considered are primarily high-nickel alloys with chromium and iron. Our tests have shown that the best finish can be obtained when the material is annealed in a high-hydrogen atmosphere such as obtained from cracked ammonia. In order to obtain uniform hardness, close control of the annealing temperature is essential. The work must be uniformly heated to the desired temperature and held long enough to get a uniform anneal.

There have been many proposals and methods suggested for the process annealing of thermostatic bimetals. Many processes could handle the uniform anneal and bright finish requirements, but could not handle the mechanical end. Donald H. Gardner, metallurgical engineer, of the Sunbeam Stewart Industrial Furnace Div., Sunbeam Corporation, invented a satisfactory solution to all three requirements. This was done through the development of a twin-belt electric furnace to convey the work through the heating and cooling chambers.

The function of the twin-belt furnace is to restrain the normal deflection of the thermostatic bimetal during the heating and cooling cycles. The work is loaded onto the loading platform and started between the belts into the furnace. The pressure of the belts is sufficiently great to convey the work into the heating chamber at constant speed and on through the cooling chamber, where the work is discharged bright and annealed. The total length is 48 ft. including the extension on the charging end. The heating chamber is 8 ft. and the cooling chamber 16 ft. long.

The previous method of annealing consisted of two salt pots which operated in conjunction with a spray bath and quench tank. The work was processed in 150-lb. batches thus:

	Labor Men	Labor Minutes	Man Minutes
1. Coil for salt anneal	2	15	30
2. Place on hangers	2	15	30
3. Salt anneal	1	75	75
4. Quench	2	5	10
5. Soak (removes salt)	1	5	5
6. Straighten	2	15	30
7. Brush to remove balance of salt	2	15	30
8. Coil	2	15	30
9. Pickle in acid	2	20	40
10. Straighten	2	15	30
11. Brush	2	15	30
12. Dry	2	15	30
			370

This batch process required 6.2 hr. to anneal, clean, and ready for rolling 150 lb. of metal at the following approximate cost:

Labor 6.2 hr. at $1.50	$9.25
Acid cost 2¢ per lb.	3.00
Metal loss	3.00
Wiping rags	.25
Salt loss 5 lb. at 2¢ lb.	.10
Pot alloy cost at 1¢ lb.	1.50
Gas for 1¼ hr.	.18
	$17.28

Approximate annealing cost per pound was $0.12. In addition to the cost, some of the other objections to this process were the fumes, dirt, and noise. There were also considerable hazards involved to the personnel when the molten salt was washed from the hangers and work. The work was first placed in a water spray to cut down the violence of the explosion and then was immersed in the quench tank to soak off as much excess salt as possible. Twelve operations were required before the material was ready to roll again.

Because of advancing labor costs, it was decided to investigate more economical and better methods of annealing the heavier gages between cold-rolling operations. Bell-type furnaces were rejected for several reasons. Among these are long cycles for loading, annealing, cooling, and unloading. Also the labor would be high for coiling the stock to be placed in hangers for this equipment. It was felt that the installation would be too cumber-

some and expensive to operate. The conventional electric strip-annealing furnaces were not suitable for heavy stock due to the high losses involved in spotwelding short strips together to produce continuous lengths.

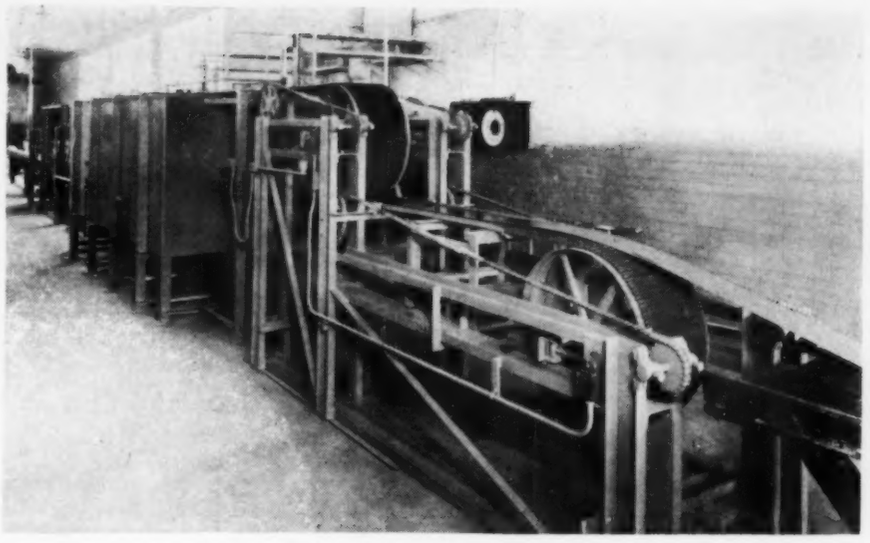
What was required was a continuous electric atmosphere furnace which one man could operate and where the strips are fed in one end and come out the other bright, uniformly annealed, ready for rolling. These conditions have been satisfactorily met by the furnace now in operation. The estimated cost of operating this 60-kw. electric furnace at 200 lb. per hour is:

Labor, 1 man at 1.65 per hr.	$1.65
Belt cost	0.50
Electricity at 2¢ per kw. hr.	1.10
Hydrogen and water	0.50
Degreasing solvent	0.20
	$3.95

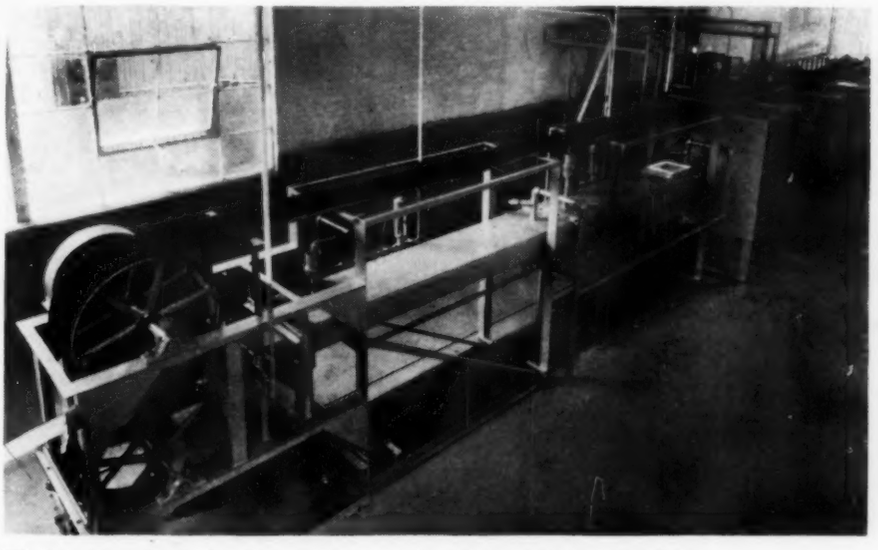
With 200 lb. of work at $3.95, the cost is approximately $0.02 per lb. In both of these calculations only operating costs have been considered, pots and belts being classified as an operating expense. Replacement of refractories and burners on salt pot furnaces is usually more frequent and expensive than similar maintenance of the conveyor furnace, and as it would be difficult to estimate these costs with any degree of accuracy, it seemed conservative to consider maintenance costs as approximately equal.

This furnace was developed by close cooperation between the W. M. Chace Co. and the furnace manufacturer. Tests were made on the actual load developed by the thermostatic bimetal during heating and cooling in the heavy sizes to see what stresses would be imposed upon the traveling belts. These tests determined the size of wire used in the woven wire belt. An alloy of 35% nickel, 15% chromium, balance iron, was used. Additional design data such as rate of annealing at specified temperature versus speed of travel through the furnace was worked out.

Basically it is of the belt-conveying atmosphere-controlling type such as used for bright annealing, silver soldering, and powder metallurgy. The feature is the second conveyor belt directly above the main belt which serves to hold the bimetal strip flat during its travel through the heating and cooling chambers. Provision is made for easy loading by extension of the lower belt at the charging end.



Charging end of the furnace. Work is fed onto the lower belt extension in strip form



Discharge end of the furnace shows the 16-ft. cooling chamber

The atmosphere (cracked ammonia gas) is sealed by means of heavy adjustable felt seals. The heating elements are located at both sides, top and bottom, in the heating chamber section of the furnace and are mounted on special refractories and support bars so that they can be easily replaced if necessary. Extra wattage is supplied to the furnace at the charge end.

The entire furnace and cooling chamber is of welded construction except for the top section of the heating chamber which is bolted to the shell, using a gasket seal. Because of the flammability and explosive characteristics of the cracked-ammonia atmosphere, blow-out ports are provided as shown. The cooling chamber is a standard water-cooled counterflow type and is in two sections, totaling slightly more than twice the length of the heating section of the furnace. The flow of water is controlled by automatic thermostatic valves. This cuts down the excessive consumption of cooling water. Adjustable and automatic takeups are provided for both belts, providing a proper and uniform tension.

Temperatures are controlled in two zones of the heating sections of

the furnace using Brown electronic recording and indicating potentiometers. Due to the deteriorating effect of hydrogen on thermocouples a 1-lb. air pressure is maintained inside of the thermocouple protecting tubes.

When the furnace was placed in operation, the only changes necessary were addition of guide rolls to insure alignment of the belts and one additional idler roll.

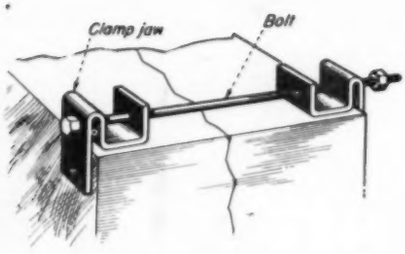
A degreasing process is used in conjunction with this furnace to remove oil and dirt from the metal so that it will not be introduced into the furnace atmosphere. This unit employs the same principle of top and bottom twin belts to convey the bimetal strips through the degreasing vapor in a continuous, curved line.

Production is now running 200 to 240 lb. per hr. Uniform hardness is produced which is a great advantage during subsequent cold-rolling operations. Hard spots in the strip stock are evident to the rolling-mill operators as they affect the pressure on the rolls and bearings of the rolling mill.

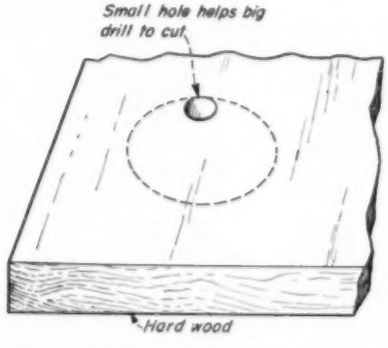
To eliminate hazards associated with use of hydrogen atmospheres, the furnace is purged at the start and finish of production with 30 cu. ft. of tank nitrogen gas.

All sizes from the longest to the shortest can be run with a minimum of delay and special processing and handling. Among the advantages gained by use of this equipment are the improvement in the quality of the product and a lower operating cost. Improvement of quality is always of prime importance and the lowering of operating costs (from $0.12 to $0.02 per lb.) is especially important during a time of rising costs. Also the morale of the workers is increased because of better working conditions in the plant by elimination of the dirt and hazards of the previous process.

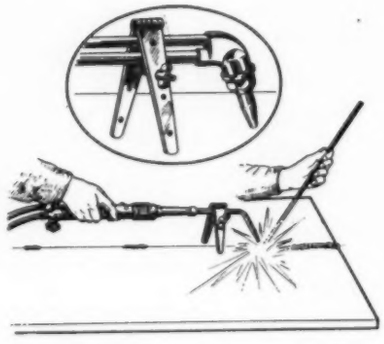
Short Cuts FOR THE SMALL SHOP



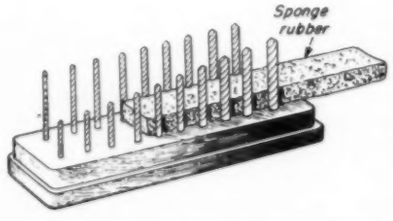
POWERFUL CLAMPS for large work beyond the range of C-clamps can be made as follows: Take two pieces of heavy strap iron and form as shown. Drill through holes for the bolt. A considerable range of adjustment can be obtained by cutting a long thread on the bolt.



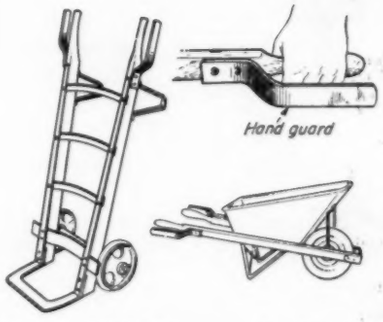
HARDWOOD must be drilled occasionally in the shop, particularly if some member of the equipment is made of such material. But drilling of extremely hard woods with the usual wood bit is difficult, especially if the hole is of large size. To give the drill lips a better bite, drill a small hole just inside the circumference of the proposed large hole.



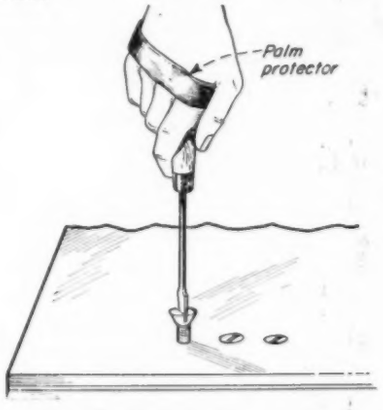
A BALANCER for the hand torch when welding long seams is easily made from a hinge. Clamp the hinge to the torch with a machine screw and wingnut. The spread hinge leaves then act as legs to support the torch.



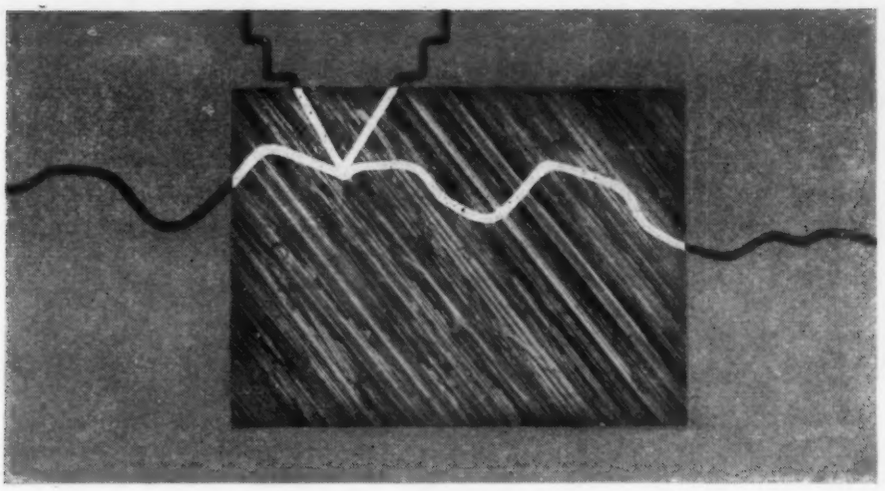
SPONGE RUBBER strips inserted between the rows of drills in a drill stand will prevent loss of tools if the stand is upset or laid into a toolbox.



HAND GUARDS on wheelbarrows and shop trucks will save skinned knuckles or worse accidents. Make the guards of strap iron and rivet them to the handles of the equipment.



A PALM PROTECTOR when driving screws can be made from a band cut from an old motorcycle inner tube. The band is slipped over the hand to avoid palm blisters and does not interfere with free use of the fingers.



How Smooth is Smooth?

SPECIFICATION AND EVALUATION OF MACHINED FINISHES

PART II

Now that the engineer has the means to specify permissible surface roughness in terms of a single numerical value (see Part I), it is essential that the shop select suitable means of measurement. Specimen blocks and some surface analyzers were described earlier. This Special Report concludes the discussion of qualitative and quantitative methods for measurement of surface roughness, begins with optical comparators.

BY BEN C. BROSHEER
ASSOCIATE EDITOR

OPTICAL comparators, like the Comparoscope introduced during the war by Compar-Instrument Company, show only a plan view of the surface, can be used on production lines and job-lot operations for rapid checking of surfaces against masters. They provide only a qualitative comparison, but make possible inexpensive control of surface quality. Master standards must be made of the same material and be finished by the same process as the pieces being inspected.

The Compar comparoscope is principally a dual microscope in which an oblique beam of light is thrown upon a master specimen of known quality as well as upon the surface under examination. Both images are reflected back, magnified 30X, into a single eye-piece in which the observer sees both images side-by-side under identical conditions. The master specimen can be of any shape or size up to 1½ in.

A companion instrument has a 16-stage turret in place of the master stake. With this unit, 16 masters, or eight pairs of limiting masters, of any desired group of surfaces are available. Turrets are interchangeable. An internal comparoscope also has been made for checking bores of workpieces against masters.

Comparison microscopes of the type described were used in Europe before the war. Typical are

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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the 30X comparison microscope made by Taylor, Taylor & Hobson in England, and the 40X comparoscopes made in Germany by Busch, Klemm and Zeiss. In some cases, a magnification range of 15X to 200X is obtainable with different objectives. All of these instruments are self-illuminating, self-focusing, self-aligning, and may be used without adjustment on practically any surface.

Jost (58)* has listed the following advantages for comparison microscopes: (a) surface being inspected is not damaged, (b) directional properties of surface can be determined, (c) method is simple and little skill is required, (d) instruments are light and simple to handle—surface can be inspected while work still is in machine, (e) comparison photomicrographs are obtainable with photographic attachments. Clay (50), however, points out the problem of satisfactorily illuminating surfaces which are of widely varying diameter.

Reason (72) believes comparison microscopes are at their best for showing differences between specimens finished by different processes, and at their worst for showing differences between nominally similar parts. The eye seems to assume that the roughness increases according to the apparent pitch of whatever markings predominate, so that as the magnification is increased, emphasis is thrown on progressively shorter wavelengths. Specimens are graded on a basis which may bear little or no relation to the readings of a stylus instrument; and while quite considerable differences in finish may be observable in some cases, considerable differences may be missed in others.

Optical Flats Check Flatness And Waviness

FLAT surfaces can be tested for flatness, parallelism and size of dimensional accuracies in millionths of an inch with light rays. Equipment needed for measuring either surface or dimensional properties is an optical flat and, for best results, a source of monochromatic light (single wavelength or color).

Optical flats can be used for determining the waviness of a finely finished surface. However, complicated waviness patterns result in complex band patterns difficult, if not impossible, to interpret.

Micro-Interferometers Measure Fine Surfaces

LIGHT interference (Newton's) rings are formed if light is passed through an air film or air wedge between two surfaces. This phenomenon has been applied to checking the accuracy of finely finished surfaces through application of special forms of the interferometer. This is an optical instrument using light waves of known length accurately to determine or compare linear dimensions.

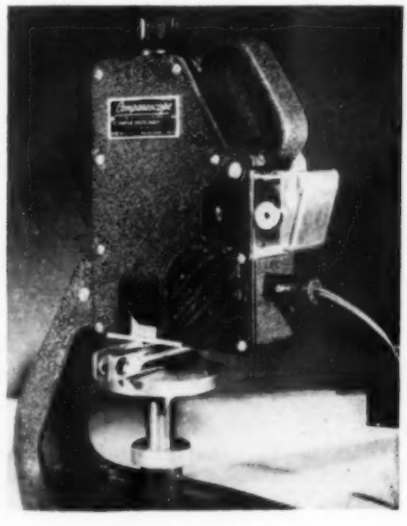
The *micro-interferometer* first described by W. Linnik (14) is mentioned by Way (26) as being suitable for studying surface profiles below the point where microscopic examination leaves off—at about 20 micro-inches (0.000020 in.) It is not applicable to the measurement of coarse surfaces. The instrument essentially is a microscope with an inclined glass or quartz surface mounted between the objective and the work surface.

The Zeiss *interference microscope* is a laboratory instrument with microscope magnification of 680X. It is intended for the inspection of surface roughness on sufficiently reflecting surfaces in the range of about 2 to 80 microinches (0.05 to 2 micro-millimeters) maximum peak-to-valley height. Opaque surfaces are not amenable to measurement.

At the Gage Laboratory, Frankfort Arsenal, the Zeiss interference microscope has been found especially adapted to the detection of depth of surface scratches and "lapping fuzz" on gage blocks and similar surfaces which require a high degree of finish. It is not considered suitable for production inspection.

A micro-interferometer using a sodium vapor lamp as the light source has been made by Pitter Gauge

* *Numbers in parentheses refer to items in the bibliography published with Part I.*



Comparoscope made by Compar - Instrument Company can be used for bench comparison of small parts with master specimen, or can be carried to machine for checking work in process. Type S has narrow body, permitting inspection of surfaces in close spaces

& Precision Tool Company Ltd. in England. This portable unit was suitable for checking large shafts, rolls and flat surfaces, but only of fine reflective character. A new model may be available.

Photomicrographs Of Surface Conditions

WHILE photomicrographs (full scale up to about 10X magnification only) of surfaces have been helpful to the study of surface roughness and flaws, considerably magnified photomicrographs are usually preferred. Projection microscopes, described above, are sometimes used to make them, but more often the required photographs are taken with camera attachments on microscopes optical surface comparators or micro-interferometers, or with standard photomicrography equipment such as is manufactured by Bausch & Lomb Optical Company.

Photomicrographs are desirable because no system has yet been devised for describing accurately in words or numbers what is seen through a microscope when examining a surface. While the depth of the irregularities on a surface cannot be shown in such photographs, their plan view and quantity are usually revealed. And for some purposes, this information is just as important as other geometric dimensions. Usually photomicrographs are of most value when they can be correlated with surface measurements made with a stylus instrument.

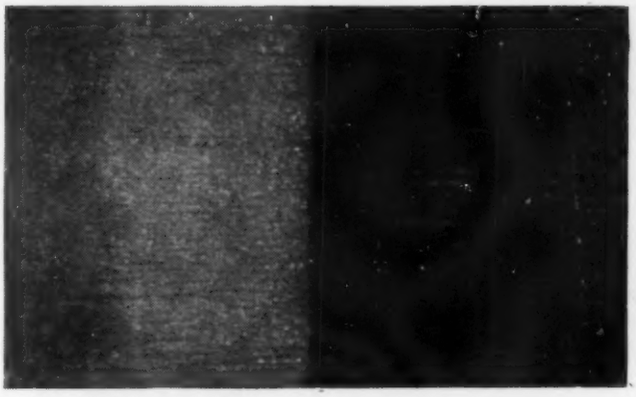
Oblique lighting generally is preferred for photomicrography. When scratches on the surface are parallel, it sometimes is helpful to make two photomicrographs, illuminating the surface across the grain for the first exposure and with the grain for the second.

Photoelectric Measurement Of Reflection

The ability of a finely finished metal surface to reflect light (sometimes called "shininess") is one of the important indications of surface smoothness, depending on the direction of illumination with respect to the angle of inspection. For this reason, photometric instruments which measure the reflection of light from a controlled source, and which assess surface quality in terms of percent reflectivity, have some applications.

When a beam of light is projected upon a surface, the reflected light that can be focused on one spot will depend upon the irregularities on the surface which cause the light to be broken up and reflected in many other directions. Thus, if a known quantity of light is directed at a surface, and a light meter is positioned to measure the amount of light reflected truly, a measure of surface quality is obtained. Surfaces so tested must be clean.

A number of studies in the use of reflected light as a measure of surface quality were reported by Schmaltz, and Swigert (21) described a portable glossmeter that would seem to have some applications of value.



Photomicrograph taken with Comparoscope shows images of master and part surfaces side by side. Both surfaces shown have same microinch rms rating when checked with Profilometer, but surface at left has many interruptions, while flatter surface at right has four times the bearing area

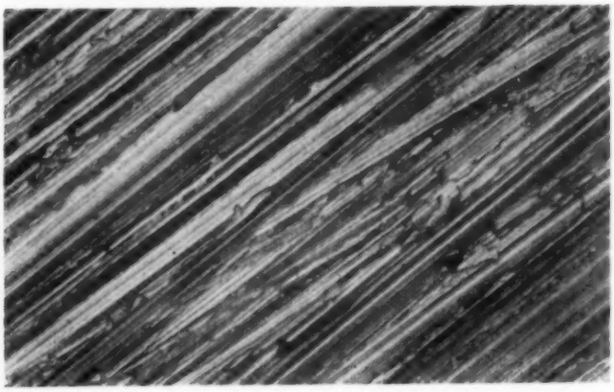
Photoelectric quick-scanning Surface Comparator made by Comtor gives fast evaluation of finish-ground steel surface in terms of percent of light reflectivity of platinum-coated, optically-flat glass standard. Speed of use is such instrument can keep up with centerless grinder

A more recent development is the photoelectric "Surface Comparator" developed by The Comtor Company for evaluation of finer finishes (30-40 mu. in. rms or smoother) on steel parts. Extremely small differences in very high finishes can be detected. Small to medium-sized parts can be checked.

This Comtor instrument consists of a photoelectric scanning head, a self-contained amplifier with calibrating controls, a finish meter equipped with movable tolerance markers, and a work carriage with accessories for holding flat or cylindrical parts. Scanning head is activated through an optical system by light projected to and reflected from the work surface. Response is not influenced by the direction of the finish lay. The scanning head averages the surface finish in an area about 1/32 x 5/32 in. in terms of a percentage of standard.

Another photoelectric reflection meter is one (94) developed in Germany during the war. It first measures the light from the investigated surface when

Bench model Faxfilm D-30 dual projector for surface replicas in 2 × 2 in. frames permits quick side-by-side comparison of replica from standard surface with one from production part. It enlarges images to 30X magnification on screen in base



Rough ground steel surface (100X) as viewed on the screen of a Faxfilm C-1000 Comparator. Quality-control superintendent of a large plant claims to estimate roughness values from Faxfilm replicas within 5% of Profilometer readings on surfaces from 5 to 30 mu. in rms.

illuminated as a bright field and then measures the light reflected when the surface is illuminated from all sides as a dark field. The ratio obtained from these two readings may be regarded as an index of the relative quality of the surface. The instrument has proven useful on cylindrical and flat surfaces that show a surface variation ranging from 20 to 0.5 microns. Tests have shown a close correlation between readings taken with this instrument and the absolute roughness of the test pieces.

Hunter (91) of the National Bureau of Standards has described a glossmeter for rapid comparison of the roughness of somewhat similar machine-finished surfaces. The instrument was designed with a near grazing 75° angle of specular incidence. The converging beam from the lens is directed onto a machined surface at right angles to the tool marks.

Since readings depend on profile shape rather than profile dimensions, the instrument is not suitable for roughness comparisons where tool feeds differ appreciably from specimen to specimen.

Translucent Surface Replicas Record Roughness

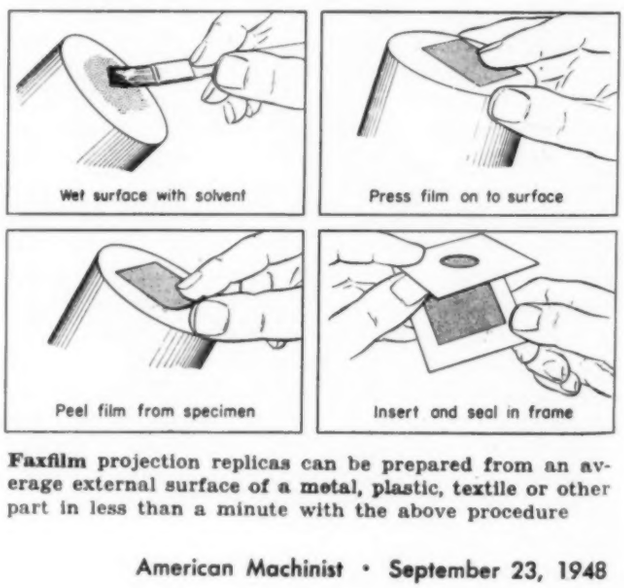
The condition of any solid surface, even on metals so soft that they would be scored if explored with the stylus of a tracer-type instrument, can be studied with considerable gain by making translucent film replicas by several methods. Such nearly transparent plastic film replicas can be handled like a photomicrographic negative and enlarged with a projector for study of the plan-view distribution and orientation of surface irregularities and defects. Most users agree that the method is much more accurate than checking by direct visual observation of the finished parts.

Best known of the plastic film replica procedures is the one marketed by The Faxfilm Company. The material is a specially prepared strip of gelatin-coated celluloid and a solvent. Steps required for the preparation of a Faxfilm replica are sketched.

Frames for Faxfilm replicas are made to expose a ½ in. diam. circular portion of the replica, making available for study a larger portion of the surface than is available with most other surface-evaluation methods or instruments.

As with other methods in its category, Faxfilm replicas can be used to examine inside and outside surfaces, cones, spheres, compound curves and vertical surfaces almost as easily as straight flat surfaces. It is one of the few methods with which the surface condition of gear teeth can be checked satisfactorily.

Surfaces difficult or impossible to evaluate by other methods have been checked satisfactorily with film replicas of this type. These include the finish in flutes of twist drills on commutators to determine the most satisfactory machining method, studies of bores of small rubber extrusion molds, and of surface porosity on chromium-plated cylinder liners.



Faxfilm projection replicas can be prepared from an average external surface of a metal, plastic, textile or other part in less than a minute with the above procedure

Qualitative Evaluation of Surface Quality

TRACER-TYPE instruments have played the major role in progress of surface evaluation during the past 20 years. Their developments made available a generally acceptable numerical index for surface roughness for use in writing specifications, and for comparing surfaces made in widely separated plants. In combination with the microscope and the photomicrograph, or with the translucent plastic surface replica, the tracer instrument makes it possible to obtain a fairly complete picture of many important characteristics of a machined metal surface.

As has been pointed out by Abbott, the tracer method is basically simple. A fine tracer point is drawn over the surface to be measured, and the vertical motions of this point are magnified and recorded, or measured by an averaging type of electrical instrument, to provide a measurement of the profile followed by the stylus point.

The essential features of a stylus instrument for measuring surface roughness include, according to Reason, Hopkins and Garrod (46), the following:

1. A measuring head carrying a stylus mounted for motion *perpendicular* to the surface to be tested, and an indicating device coupled to the stylus.
2. Means of traversing the measuring head across the work. Both manual and mechanical means are in use.
3. Means for providing a datum-line with respect to which the up and down movements of the stylus can be measured.
4. Means for providing a graph or numeric value representative of the cross-section profile of the surface.

Available profile recording instruments are: the Profilometer, Brush Surface Analyzer, and the British-made Tomlinson, Topograph and Talysurf instruments. Consider what they are required to do:

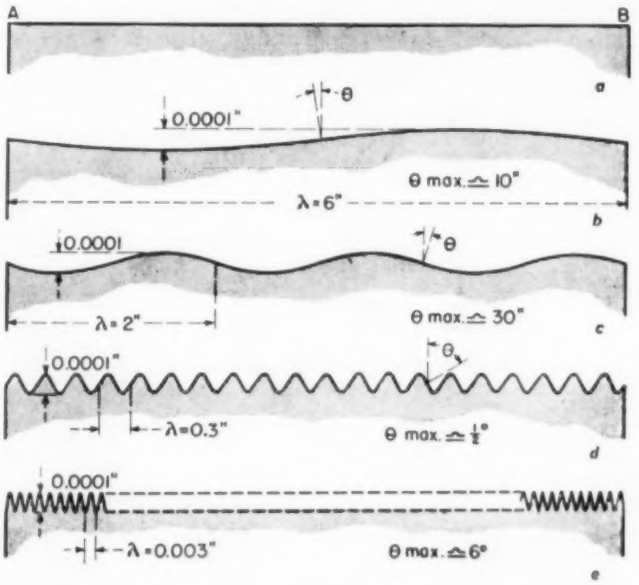
Reason (72) graphically described the effect of effective wavelength of surface irregularities (including both roughness and waviness) on surface quality. See sketch. Line *a* represents the profile of surface *AB* supposedly smooth and flat. If the line is slightly wrinkled *b* with a wavelength of 6 in. to a depth of 0.0001 in., it still has a high order of flatness. But, if the wavelength is progressively reduced *c* to *e* with the depth remaining constant at 0.0001 in., both the visual and the mechanical quality of the surface deteriorate until it compares with medium-grade diamond turning. Thus, an excellent "smooth" surface can be turned into an indifferent "rough" one simply by changing the wavelength of the irregularities and without changing their depth at all.

Instruments measuring only the height of wavelengths (as do all of the modern tracer-type instruments) are *selective*. These instruments are sensitive only to a range of wavelengths. Transition from full to zero sensitivity occurs gradually, so a nominal value is assigned to the rated cut-off points. These cut-offs define the measurement bands of the various instruments.

With the Profilometer, the selectivity with a manually operated tracer varies with the speed of stylus traverse, while with the Mototrace-driven tracer head it transmits uniformly all wavelengths up to about 1/32 in. With this "measurement band" the instrument is usually adequate for measuring roughness up to about 500 mu. in. rms average height. With a Type A Pilotor or other means for stylus traverse speed of 0.1 in. per sec., the Profilometer has a measurment band for irregularities having a maximum spacing of about 0.010 in. and can be used for measuring roughness up to 100 mu. in. rms average height. The Talysurf instrument has a substantially uniform response up to 0.010 in. wavelength (measurement band). The Brush Surface Analyzer has a uniform response up to 0.001 in., or 0.003 in., depending on the pickup used.

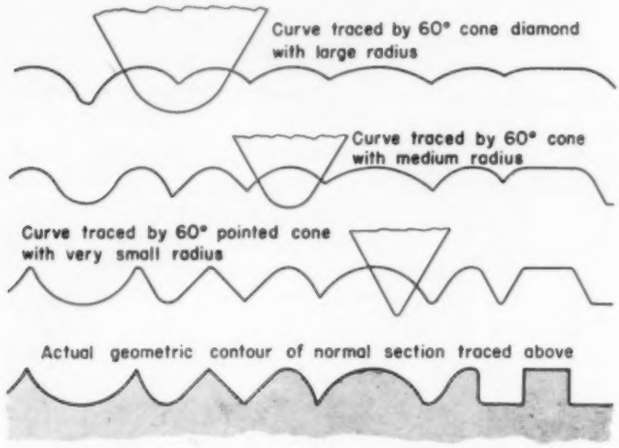
The selectivity of one instrument must be known before a roughness value reading can be compared with a reading taken with another instrument. *If two different instruments give different readings on the same surface, one of them is not necessarily wrong.* Each reading may be a perfectly good measurement of the root-mean-square or arithmetrical average height of surface roughness for a certain measurement band, the range being different in the two cases.

Rational surface dimensioning from readings taken with stylus-type instruments, should, there-



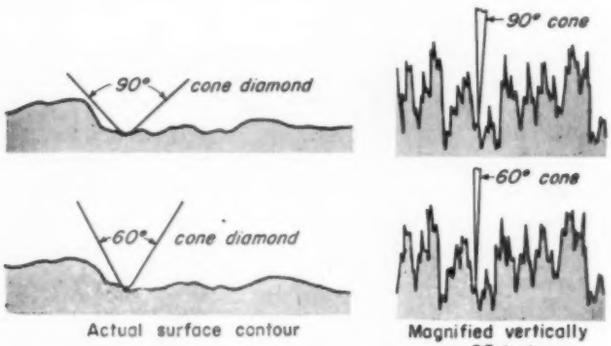
Roughness of a surface can be increased merely by shortening the wavelength of surface irregularities while holding the height (or depth) constant

fore, be on the basis of a standard range of wavelengths (measurement band) to be measured by all instruments or on the basis of the specification for a surface including both the average roughness height and the measurement band over which this roughness is measured.


Curve traced by 60° cone diamond with large radius
Curve traced by 60° cone with medium radius
Curve traced by 60° pointed cone with very small radius
Actual geometric contour of normal section traced above

Surface irregularities typical of machined surface

Even an extremely fine point cannot trace an exact reproduction of a rough surface. Tips with 90° included angle cones and with hemispherical radius of 500 microinches are small enough for most applications



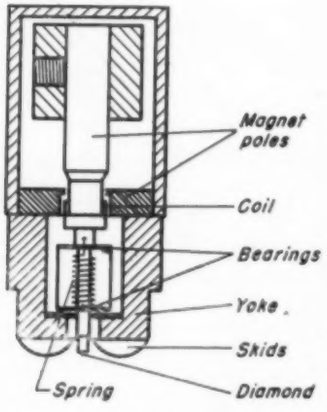
As shown by these sketches prepared by Broadston (47), the difference in penetration with 60° and 90° included-angle conical stylus tips has little effect on the reading of a surface measuring instrument of the averaging type

It is not practical to form the point of the stylus to reach into every scratch, no matter how small. A stylus tip therefore usually consists of a diamond or sapphire cone terminating in a hemispherical tip having a radius of 0.00005 in. (50 microinches) to 0.0005 in. (500 microinches). Most stylus instruments made for average readings now use a larger tip radius (up to 500 microinches). Errors introduced in the average value due to the tip radius have been shown to be negligible for machined and ground surfaces within the range of existing instruments. But it must not be assumed that maintenance of tip points can be relaxed. A diamond having an original radius of 0.0005 in. can easily be worn to one having several thousandths tip radius, the rate of wear depending upon the type of service.

Another limitation of the accuracy of tracer-point surface analyzers (46, 47) is the influence of the skids which support the tracer heads.

When drawn over the surface, the vertical motion of the stylus is measured in relation to one or more of the skids, rather than actual movement of the tracer point. This only affects the profile record produced by an oscillograph connected to the amplifier of a tracer instrument.

A common limitation of all instruments of the tracer group is the fact that graphs and/or meter readings are obtained as the result of line-tracings of the stylus and, therefore, give only a one-dimensional average or a two-dimensional picture of a three-dimensional surface. Thus, any parameter obtained with a tracer-type instrument cannot be an indication of the properties of the surface area, but only those of a line or profile curve of which there are an infinite number on the surface. In addition, such instruments cannot be used effectively on many curved or internal surfaces. Some users have found them entirely satisfactory for shop use, others think them too delicate or too expensive to be trusted to shop personnel.



Type Q Profilometer (right), with standard Type MA tracer, can be used for a wide range of production-inspection control applications. Sectional view shows principal parts of tracer head

Abbott Profilometer Designed For Shop Use

THE Profilometer, surface measuring instrument manufactured by Physicists Research Company, is an automatic averaging instrument, in that it gives directly the root-mean-square average (or the arithmetical average, if so ordered) deviation of the profile of the surface traced by the stylus. The standard electromagnetic tracer (Type MA) usually is moved across the surface manually, but can be fastened to a mechanical traversing device. Stylus consists of a diamond cone having an included angle of 90° and a 0.0005 in. (500 microinches) hemispherical tip radius. The cemented-carbide skids on which the tracer rests when tracing a surface are held in a skid mount designed to suit the shape of the surface. Skid mounts are interchangeably mounted on the tracer case.

At Mototrace speed (0.285 in. per sec.) important irregularities must not be spaced farther than 0.020 in. apart to contribute to the reading. When tracing manually, accuracy of the reading is usually not affected by speed of tracing over a range from 0.1 to 0.5 in. per sec.

A line of tracer heads, Mototrace units, piloting fixtures, and a continuous-chart reading recorder have been developed to extend the range of application of the standard Type Q Profilometer Amplimeter with its Type MA tracers.

Basic limitations of the Profilometer are:

1. It is intentionally not adapted to the measurement of unusually coarse surfaces (500 mu. in. rms and up).

2. No profile record is given, even when the *Reading Recorder* is used. This is a limitation in connection with laboratory studies of surface characteristics.

3. Relation of the Profilometer readings with the actual peak-to-valley roughness is not a constant factor.

4. Users find in routine checking of precision finished surfaces, than an "uncertainty of measurement" or "error" factor in the neighborhood of plus or minus 15% above 10 mu. in. rms, and plus or minus 25% below 10 mu. in. rms, should be used as a tolerance on the meter readings.

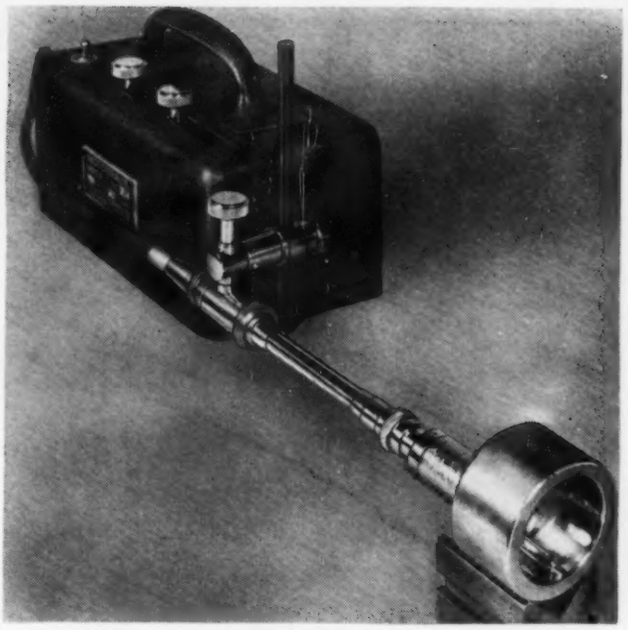
Advantages of the Profilometer are:

1. It is a sturdy instrument suitable for shop use by the average inspector or machine operator after limited instruction.

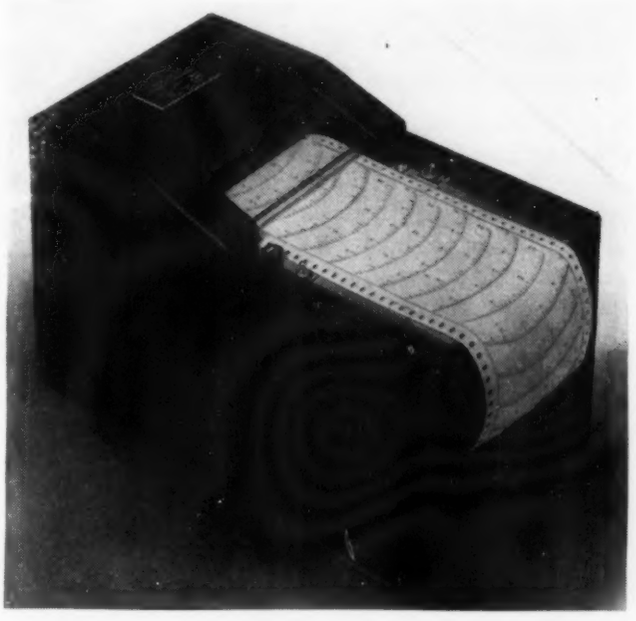
2. It gives a single-figure measurement. Computations or scaling of profile curves are not necessary.

3. It provides a quick and reasonably accurate method for making spot-check roughness comparisons of finely finished critical surfaces.

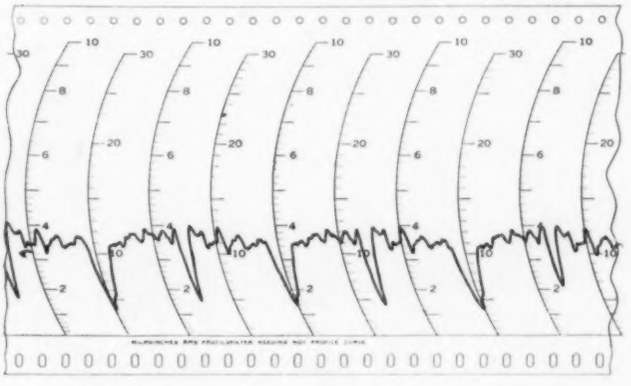
4. It is easily portable, and its calibration can be checked quickly over the glass standard specimen supplied.

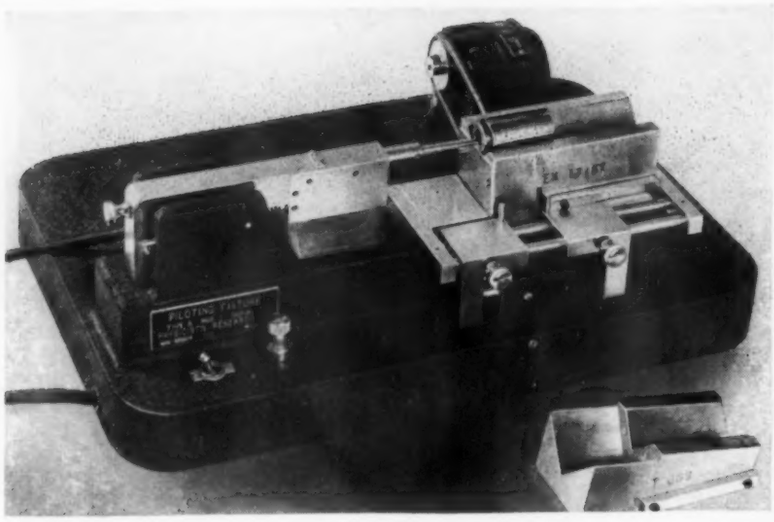


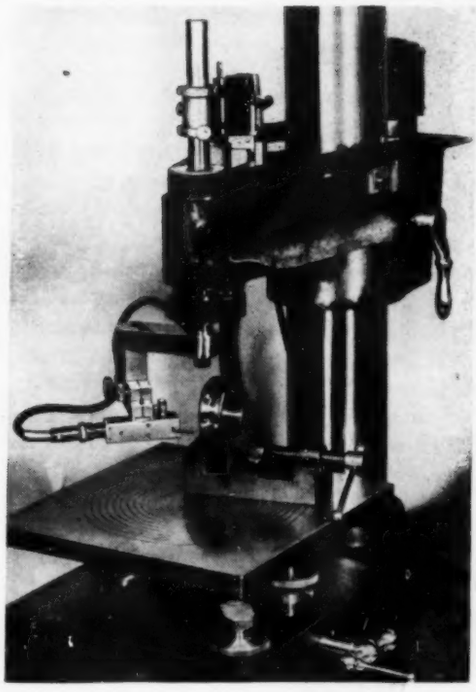
Mototrace reciprocating mechanism moves Profilometer tracer back and forth to measure surfaces on nearly all OD's and on all ID's from ¼ in. to flat



Reading recorder provides a continuous chart record of the Profilometer root-mean-square average deviation reading—not profile curve—where a record is required or where a particularly close measurement must be made







Typical of piloting fixtures for repetitive inspection with the Profilometer, this Type B fixture checks inside roughness of small dies and bushings. Surface roughness measurements around internal and external surfaces of cylinders, spheres and toroids, and on circular flat surfaces such as rings, grooves, and bosses, can be taken with the Profilometer (right), when using Type RA rotary piloting fixture. Workpiece is held stationary

Brush Surface Analyzer Records Surface Profile

THE Surface Analyzer (Model BL-103 now standard) made by The Brush Development Company records roughness profiles from ½ to 125 mu. in. rms, on a moving paper chart. Instrument has a diamond-tipped stylus with 90° cone and 0.0005 in. (500 microinches) radius tip. Analyzer head and pickup can be exchanged with other units to change the roughness range to 100-3000 microinches rms.

The Brush Surface Analyzer is adapted to inspection of microscopic surface irregularities on most surfaces normally encountered in machining operations. But, it is limited to the inspection of parts or specimens small enough to be mounted on the surface plate under the pickup arm. It is not suited for the measurement of macroscopic defects, such as waviness, nor for surfaces on very large areas.

Tomlinson Instrument Records on Glass Plate

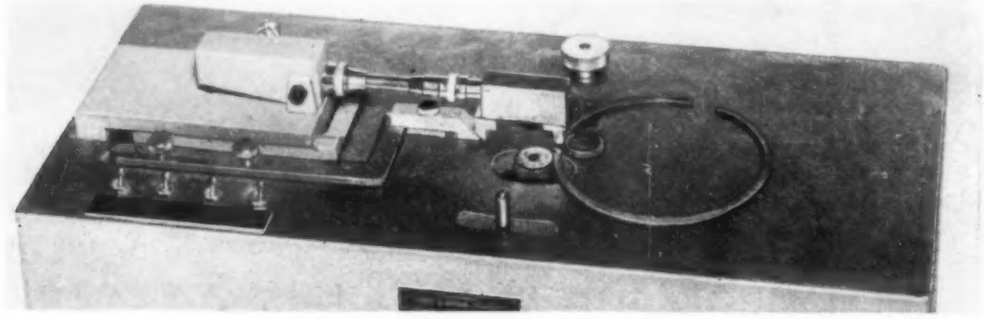
DESIGNED by the late Dr. G. A. Tomlinson of the British National Physical Laboratory, this tracer-type instrument employs a mechanical magnification system to transfer vertical movement of a diamond-pointed stylus to a smoked glass plate at 100X magnification. Made in England by J. E. Baty & Co. Ltd., this instrument records the actual profile of the inspected surface, including roughness (micro-profile) and waviness (macro-profile) within its ⅛ in. length of traverse. Internal and external surfaces, as well as inclined surfaces, such as gear teeth, can be inspected.

Topograph Is Air Operated

DESIGNED by David Brown Tool Co., England, the air-controlled Topograph provides a pen record of the surface micro-profile along a selected straight track. Normally used for flat surfaces, it also can be applied to any curved surface having a straight line along which the tracer point can be moved.

Both Graph and Meter Value Provided by Talysurf

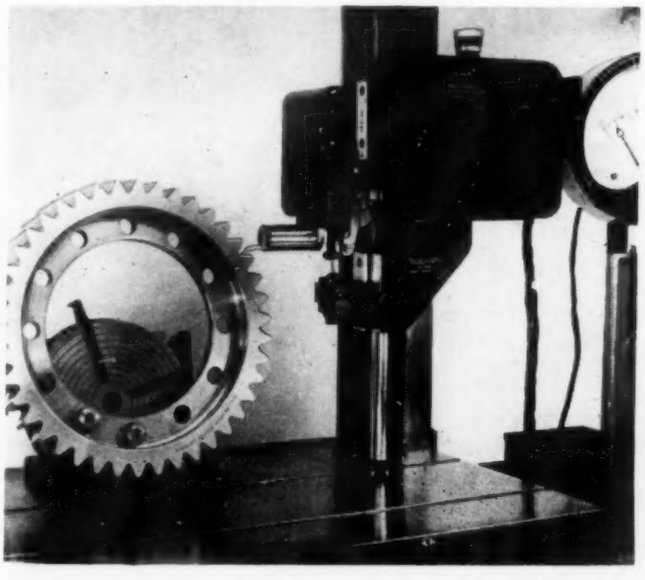
MADE in England by Taylor, Taylor & Hobson, Ltd., the Talysurf Surface Meter provides both a graphic record of the surface being checked, and



Surface finish of piston rings is checked automatically in circumferential or radial directions, either singly or together, with this Type R piloting fixture for the Profilometer

Brush Model BL-103 surface analyzer has a piezo-electric crystal pickup supported in an adjustable drive head with 1/16-in. length of trace, a calibrating amplifier, an "RMS" meter, and a direct-inking magnetic oscillograph

a meter reading representing the arithmetical average deviation (h_{ave}) of the surface texture in microinches. In this unit, the pickup with a pyramidal-pointed diamond stylus is traversed across the work surface by a motorized drive. Vertical magnification of the profile can be varied in steps between 2,000:1 and 40,000:1, and by using available accessories the magnification range can be extended down to 400:1, and up to 100,000:1. Longitudinal magnification can be either 50:1 or 200:1.

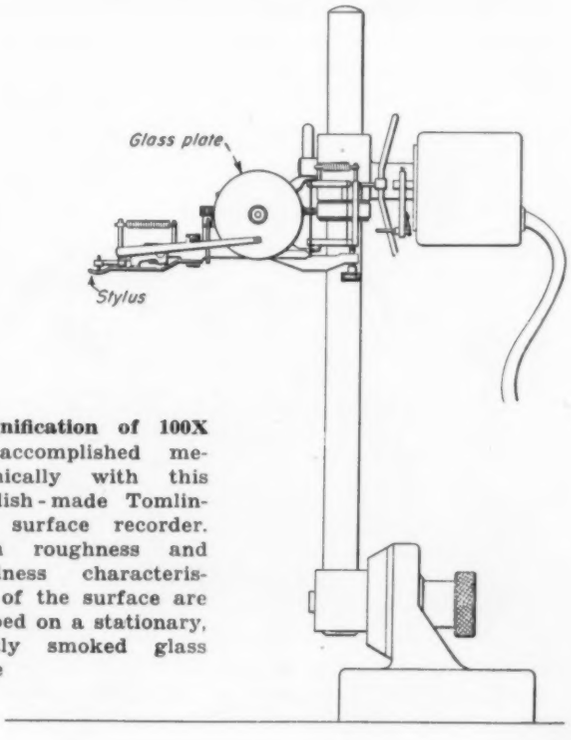


Talysurf radius attachment is used with a skidless pickup head to check gear teeth

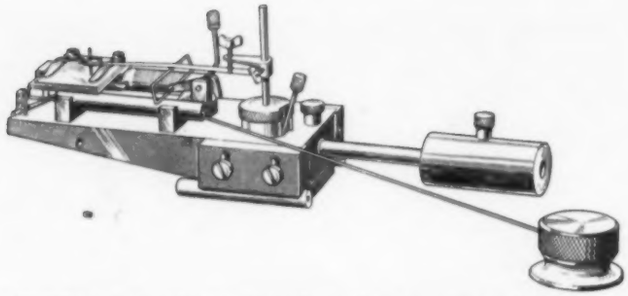
Measurement of Waviness Is Often Important

WAVINESS irregularities have a larger "pitch" or "wavelength" than the traverse feed of the machine. Usually they are the result of vibration, wear in machine elements, varying conditions in the machine traverse, and tool inaccuracies.

To measure waviness conditions, several devices



Magnification of 100X is accomplished mechanically with this English-made Tomlinson surface recorder. Both roughness and waviness characteristics of the surface are scribed on a stationary, lightly smoked glass plate



Tomlinson waviness recorder, shown arranged for use on a plane surface, is manually operated and may be placed at any desired location on a large surface. Adjustments permit checking cylindrical surfaces

Developed for measuring bearing race waviness, and for controlling production setups to secure required accuracy, the Wavometer has two microinch meters

have been employed: optical flats, precision dial indicators and other dimensional comparators, and checking against bluing gages. But now commercial surface recording tracer-type instruments are: the Tomlinson Waviness Recorder, the Wavometer and the Proficorder described below.

Tomlinson Waviness Recorder Is Portable

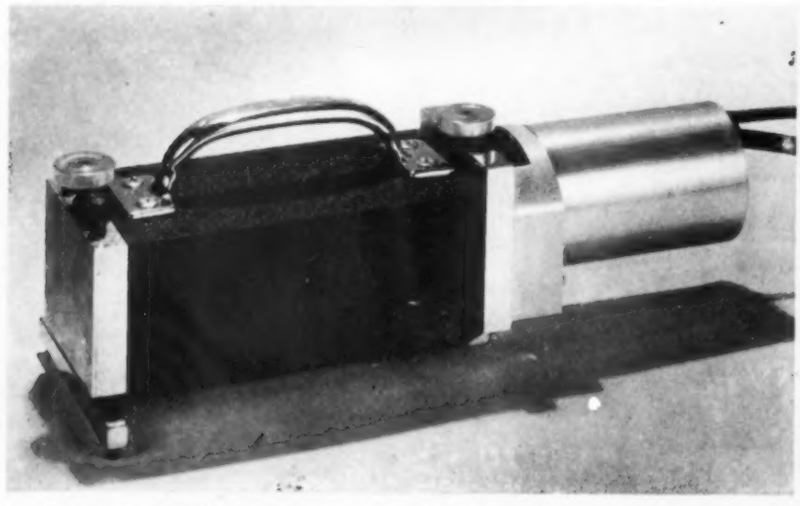
THE Tomlinson Waviness Recorder mechanically magnifiies surface undulations and records them on a smoked glass plate. Amplification is about 40X, which is increased to 400X by projection. The exploring stylus point is a 1/16-in. steel ball which passes over most of the micro-roughness, but picks up the more coarsely pitched waviness. Length of traverse may be up to 2 in.

Wavometer Measures Bearing Race Waviness

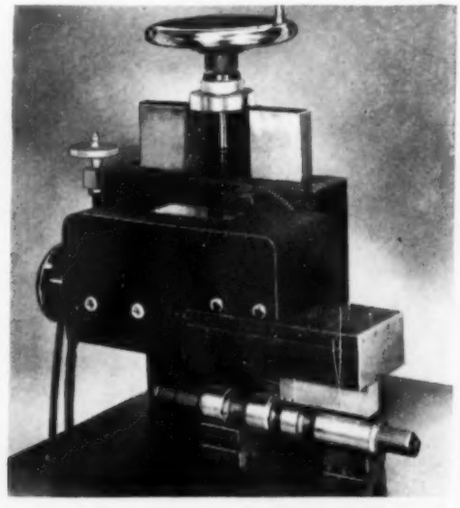
MADE by Physicists Research Company for measuring surface waviness of inner and outer ball and roller bearing races on a production basis, the Type WAA Wavometer gives direct meter readings of the microinch rms average height of the surface waves in two wave bands. It shows visually the number and shape of waves on any given race, permits detection of deviations from normal, also deviations from roundness caused by work-holding devices, vibration of grinding wheel or machine, dull or glazed grinding wheels, etc.

The Wavometer consists of a high-precision spindle driven by a special motor. Inner races are mounted on a plug adaptor in the spindle; outer races are held in a cup adaptor. To operate, the inspector slips the race onto the running spindle, holds the felt tip of the converter against the rotating surface, and makes the required observations.

One of the meters measures the average micro-



Portable RPA piloting fixture for Proficorder can be used for inspecting profiles of large flat surfaces, like machined baseplates, or large rounds, like mill rolls. With adaptor, it can check bores



General-Purpose type RLA piloting fixture for Proficorder checks practically all surfaces that can be mounted on the baseplate

inch height of long-wave irregularities—those occurring from 4 to 15 times on the circumference of the work. These might include pockets caused by grinding the race in a multiple-jawed chuck with consequent distortion. The second meter measures waviness irregularities, such as closely spaced chatter marks, which occur 15 or more times on the circumference.

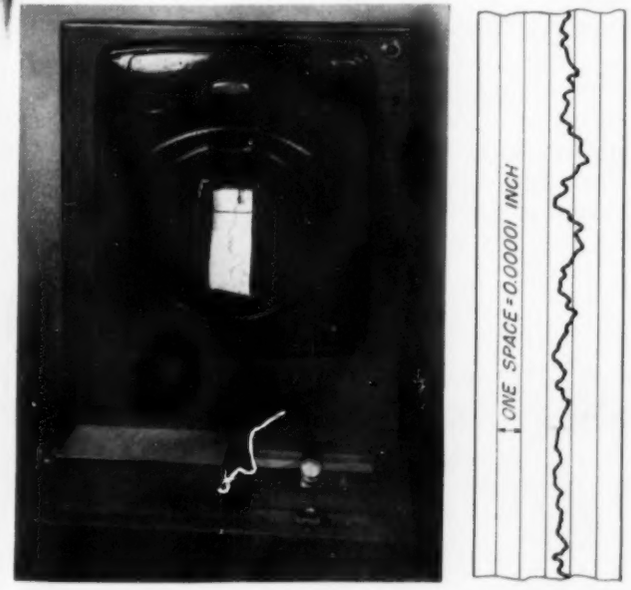
The built-in oscilloscope enables the inspector to count the number of waves per revolution and observe their general contour. A loudspeaker permits quality of the workpiece to be judged by ear.

A somewhat similar instrument, the Anderometer (54) made by the same company will make production tests of ball bearing assemblies for deviations from circularity of balls and races.

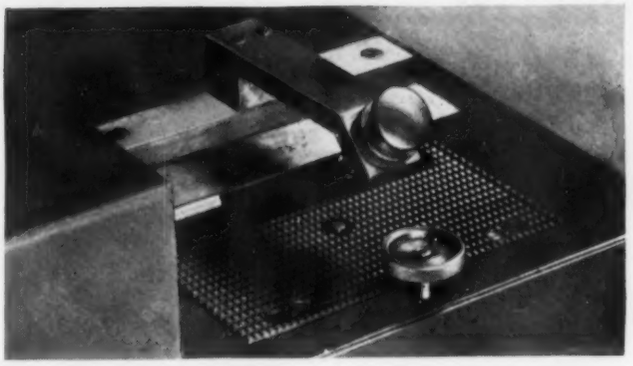
Proficorder Charts Both Roughness and Waviness

THE Proficorder (Physicists Research Company) by simple adjustments can record in graph form either roughness or waviness. This mechanical-electronic instrument provides a magnified chart record of the shape, height and spacing of surface irregularities, particularly waviness, bows, steps, plateaus, peaks and grooves spaced approximately 1/32 in. apart or farther. The Proficorder can be used for determining irregularities of setup used to produce the surface, rather than the roughness caused by the tool or grinding wheel. It permits establishment of definite tolerance limits for surface waviness and provides a means for checking the work against these limits.

In the Proficorder a tracer is moved mechanically by a piloting fixture over a variable distance of 1/32 to 2 in. or more on the surface. A range switch in the Amplicorder circuit provides vertical magnifications of 500X, 1000X, 2500X, 5000X and 10,000X. Horizontal magnification range of the Proficorder is 1, 2.5, 5, 10, 20, 50, 100 and 200 times tracing speed, which is infinitely variable from 0.0005 to 0.015 in. per sec.



Contourometer developed by Brown & Sharpe Mfg. Co. for checking chatter and other micro-profile defects on steel test samples finished in surface grinders, records surface waviness on a strip chart



Steel test samples 1¼ in. square by 6 in. long are tested for waviness on Contourometer by diamond-pointed stylus projecting up through table to bear against sample

B & S Contourometer Records Grinder Accuracy

TO OBTAIN a surface measurement of chatter marks on smooth, ground flat surfaces, which might be from 1/32 to ⅛ in. apart and so cannot be checked with the Profilometer or Brush Surface Analyzer, Brown & Sharpe Mfg. Co. several years ago built a special Contourometer that uses a tracing diamond having a 1-in. tip radius. It is used principally for making a chart record of steel test samples 1¼ in. sq. by 6 in. long finish ground on each of the surface grinders they manufacture. The unit also has been useful for controlling quality of finish-ground surfaces on milling machine and grinding machine tables.

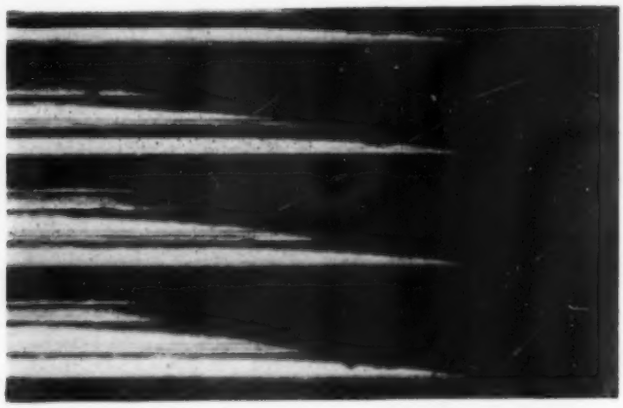
Sectioning Methods Show Profiles Accurately

MICROSCOPIC and photomicrographic examinations of sectioned surface profiles are among the most accurate surface evaluation procedures yet devised. They require laboratory equipment and take considerable time, and usually result in destruction of the part or specimen examined.

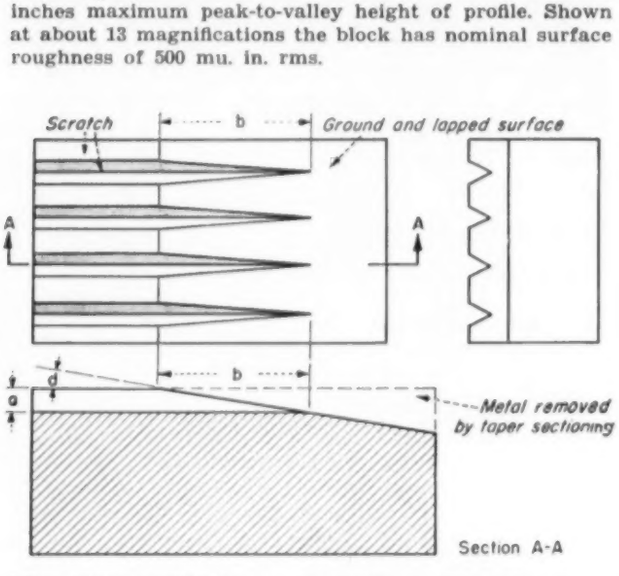
To avoid destroying the specimen, Thomas (1) made gelatin casts of surfaces being investigated, then removed the casts and cut them in thin slices with a microtome for visual examination with a microscope and with photomicrographs. For various reasons casts seldom are made today for sectioning purposes.

On the other hand, right-angle and taper sectioning procedures are important in present-day laboratory examinations of surface characteristics. This is especially true of the taper sectioning techniques perfected by Nelson (31, 33) and Darmody (101).

Right-angle sectioning of parts for examination



Taper sectioning is an accurate method for examining surface profiles. It has a lower limit of about 10 microinches maximum peak-to-valley height of profile. Shown at about 13 magnifications the block has nominal surface roughness of 500 mu. in. rms.



After taper sectioning a flat specimen, dimension B is measured easily with a toolmaker's microscope, as outlined by Darmody (101). Then, peak-to-valley depth of scratch is found by the formula: $a = b \tan d$

of surface profiles has been examined in some detail by Swigert (21).

Taper sectioning, as described by Nelson (31, 33), provides at ordinary micrographic magnifications a record of the surface profile large enough to be representative. It consists of grinding and polishing the surface along a plane at a slight angle (usually 1 to 2.5 deg.) with the plane of the surface, and with the direction of the slope parallel to the scratch direction (lay) of the surface. The plane of the section then gives an apparent magnification of scratch depth. For small angles of taper, the magnification $M=L/H$, where H is scratch depth and L is the length of its projection on the plane section. Nelson (31) and most other users of this procedure have found it convenient to use a taper angle of 2 deg. 17 min., which gives a satisfactory magnification of 25X.

It must be kept in mind that taper sectioning procedures show an apparent enlargement of the surface profile in depth only, not in the width or spacing of the scratches. Enlarged photomicrographs of taper-sectioned surfaces therefore show the same distorted profiles as are obtained with surface profile records made with tracer instruments described earlier in this report.

Both Schmaltz (15) and Way (26) have mentioned the possibility of studying surface topography by horizontal sectioning. Like right angle and taper sectioning procedures, this method has the disadvantages of destroying the part and of requiring considerable time.

Electron Diffraction and Microscopy

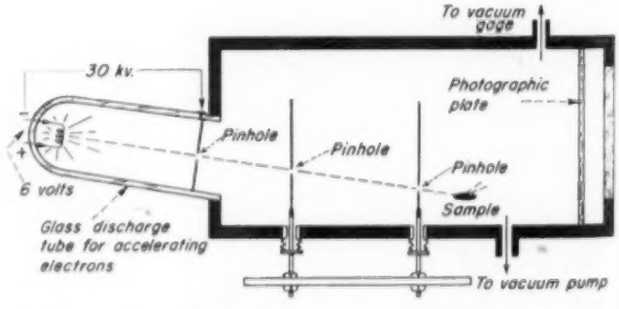
DEVELOPMENT of procedures for applying electron diffraction apparatus and the electron microscope to the analysis of surface characteristics has proceeded rapidly during recent years. Suitable only for laboratory use, these instruments are sure to bring about a better knowledge of the effect of different surface characteristics on the proper functioning of mating parts.

Because of the low penetrating power of the electron beam, data obtained by electron diffraction is confined to a few atomic layers at the surface of the material. This makes electron diffraction apparatus especially valuable for the study of surface structure, as has been pointed out by Wulff (24), Finch (70), and others.

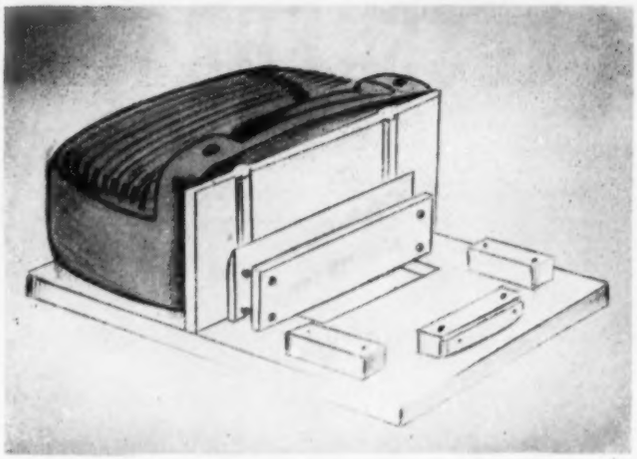
The electron microscope, developed by the Radio Corporation of America, makes possible magnifications of 25,000X when studying surface characteristics. This instrument has a magnetic field which concentrates a beam of electrons through a specimen. These are magnetically magnified and the image is reproduced on a fluorescent screen for direct observation or for more permanent recording by photography.

A number of techniques have been developed for making surface replicas suitable for examination with the electron microscope. Zworykin and Ramberg (34) described several methods.

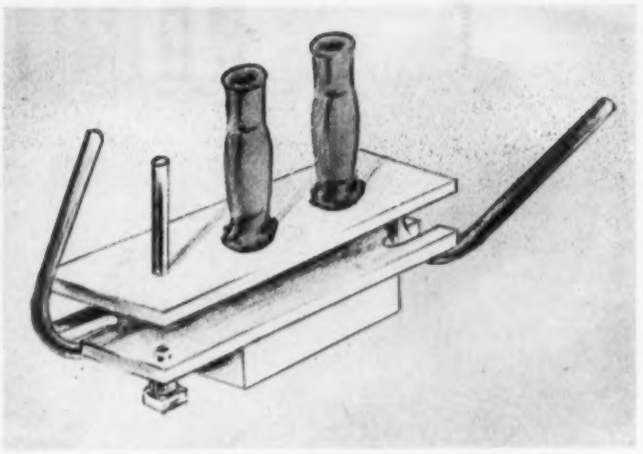
The electron microscope has a depth of focus about ten times that of the light microscope. This characteristic, as has been pointed out by Heidenreich (85), makes possible effective stereoscopic examinations.



Electron diffracton apparatus used by Wulff (24). Bombardment at a grazing angle to a metallic surface results in diffracting the electron beam to a ground glass plate where its appearance can be observed or photographed



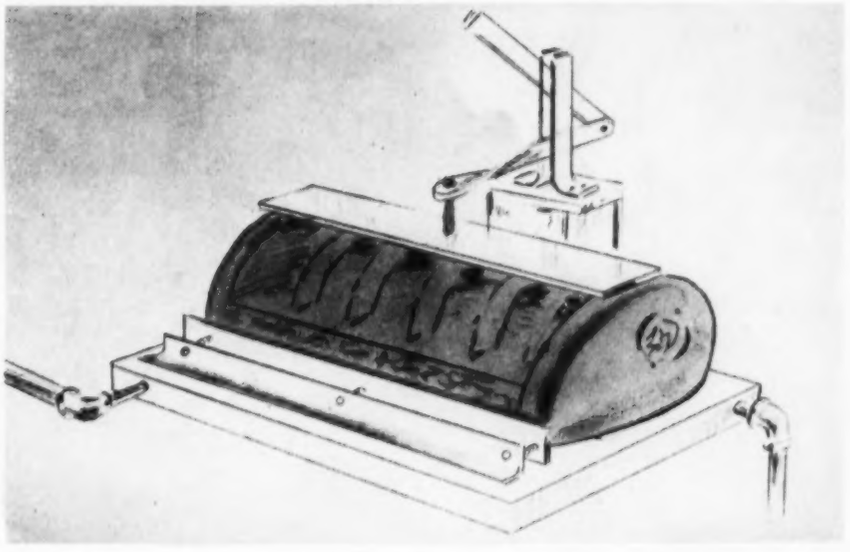
Small radio cabinets are held for approximately 6 min. in this twin steel form to prevent distortion. Air circulation and heat absorption by the steel provide sufficient cooling. The base of the piece is pressed against the central baseplate by a spring-backed plate, while the top is positioned over spacer blocks



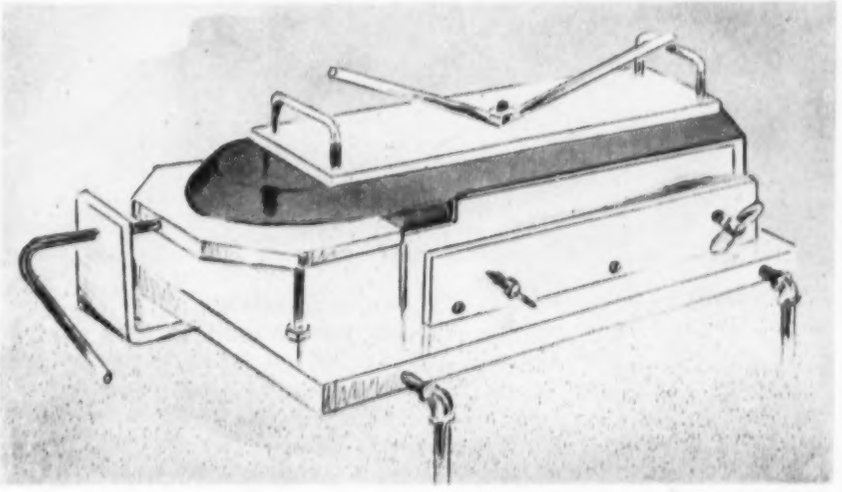
Handles for soldering irons must meet tolerances for bore diameter, concentricity and straightness. Molded handles are therefore placed over steel pins in this form for cooling. Pins are fastened to the water-cooled base, and the stripper plate "jacks" the cooled, hence smaller, handles off by means of the end levers

CONTROLLED COOLING HOLDS PLASTICS IN SHAPE

Cooling forms prevent warpage of compression-molded parts at General Electric Plastics. These sketches show principles of common types

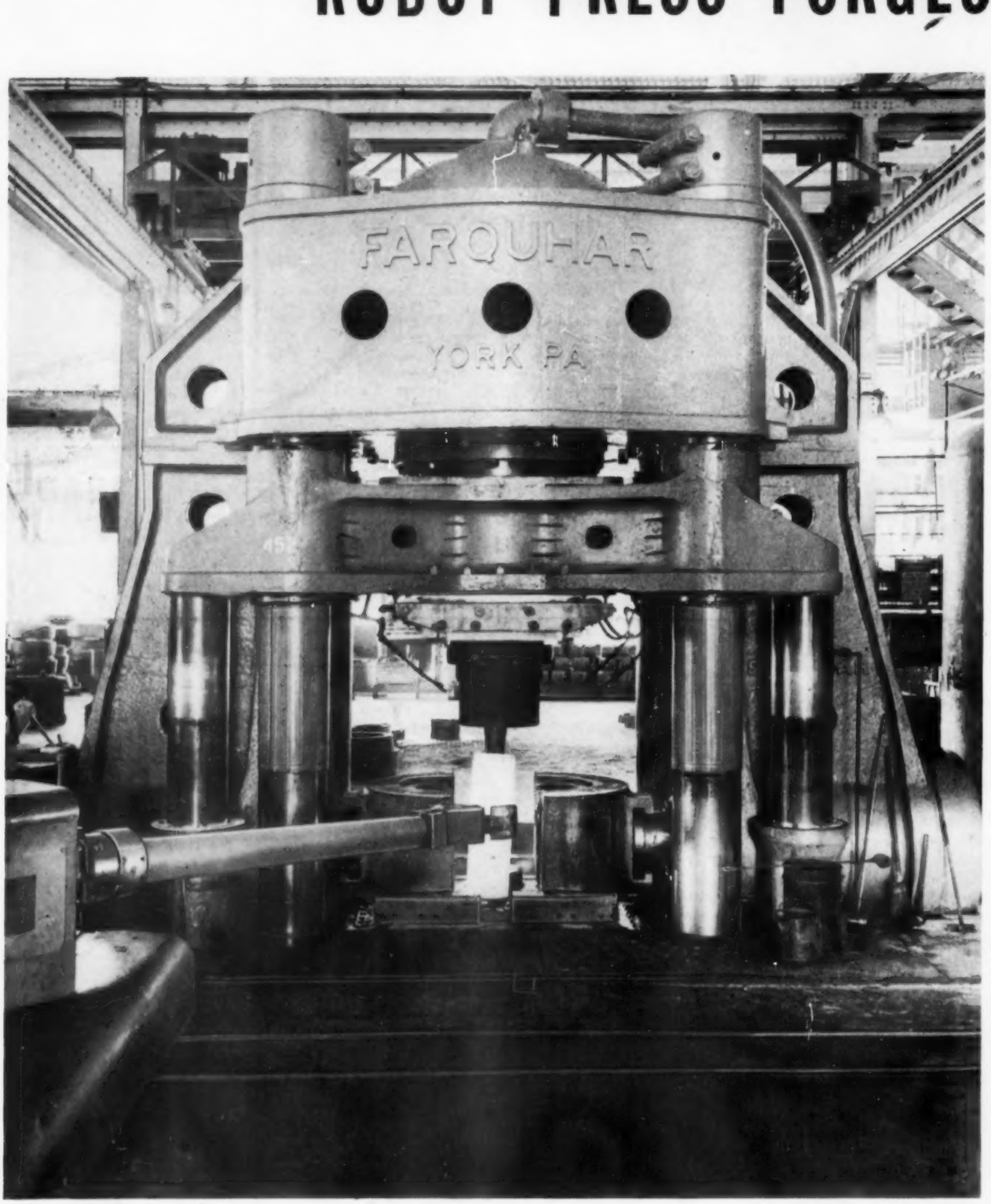


Desk-top book racks, molded in a single piece with spacers, are cooled in this simple form. An adjustable clamp on a rear pedestal presses down on a flat plate to hold the rack against the base, while another spring-mounted plate in front presses the rack against a back plate. Cooling water is piped through a labyrinth in the base of the form



This large, flat part for a coffee grinder will warp in cooling if not held rigidly. It is held in this fixture by a screwed-down top plate and screwed-in side and end plates. The base has a water-cooling labyrinth

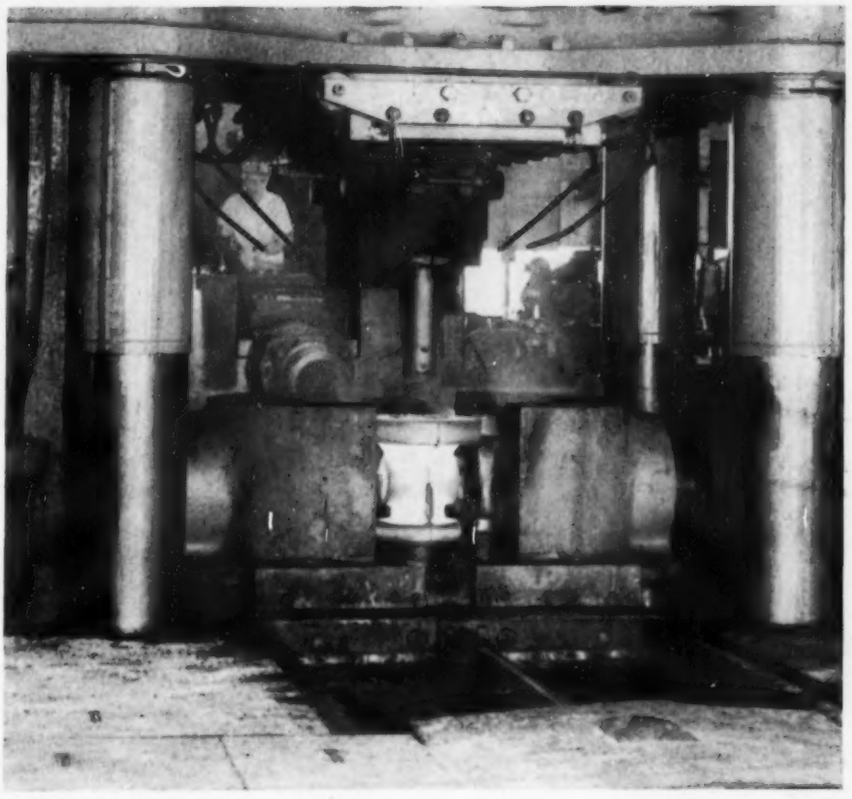
ROBOT PRESS FORGES



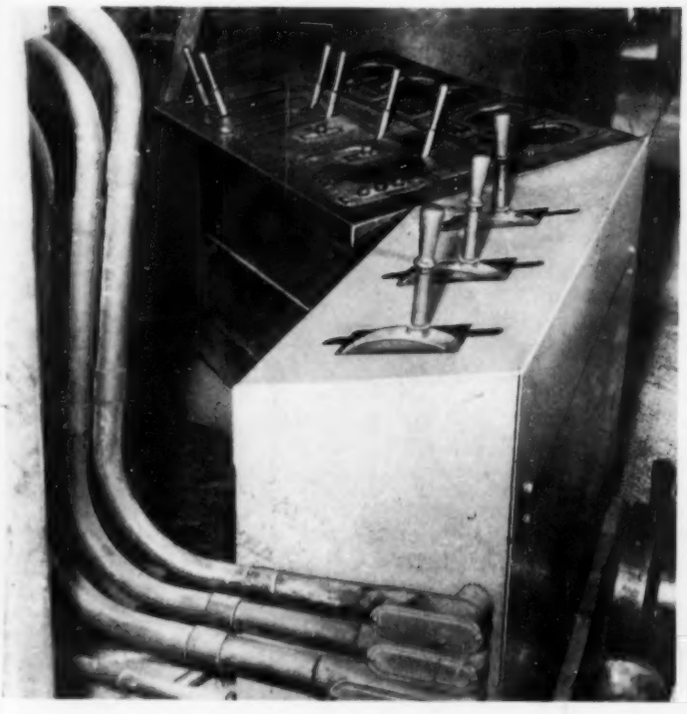
Two men, press operator and manipulator operator, and two helpers, handle operations in this 5000-ton Farquhar hydraulic press at Cameron. The special manipulator runs on rails in foreground, picks up billets from the furnace, inserts them in the descaler, then brings them to the press. The manipulator operator controls furnace and descaler as well as manipulator from his platform, by means of collector bars in the rail slots

HEAVY-DUTY PARTS

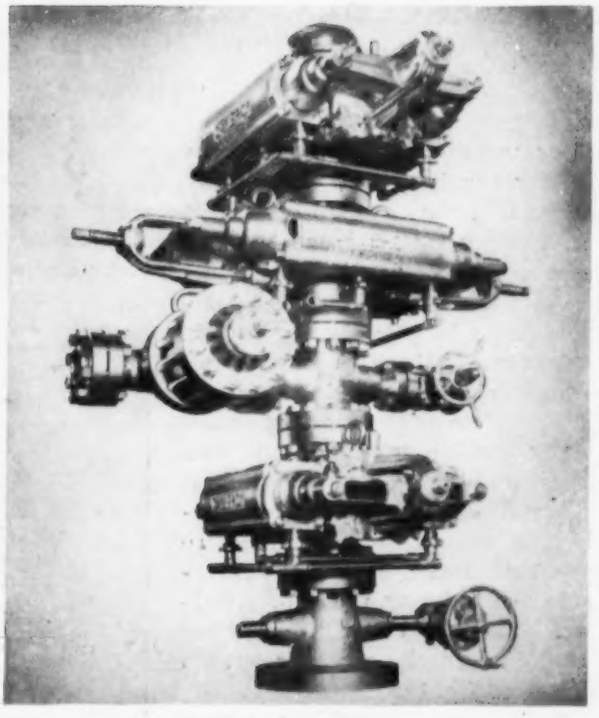
Manipulator handles 900-lb. blanks; two men and two helpers handle forging of piping elements at Cameron Iron Works, Houston, Texas



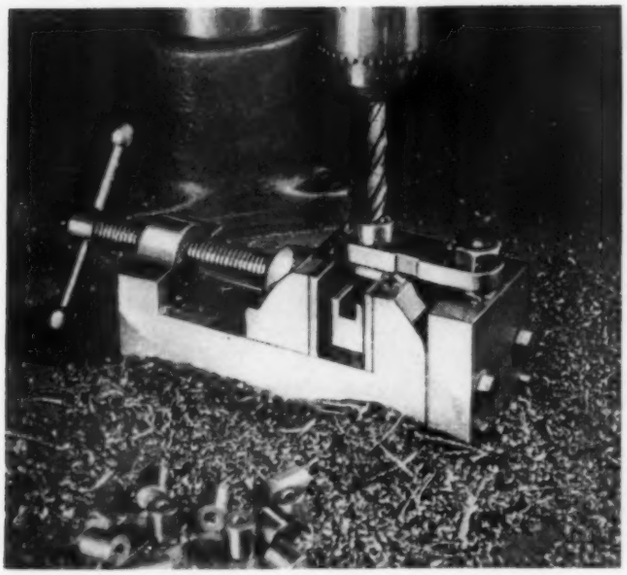
When knockout is necessary, the baseplate with dies can be withdrawn to the side by a hydraulic cylinder. A knockout ram rises through a clearance hole in the baseplate. The manipulator is visible behind the press. The forging in this case is an 860-lb. double-flanged tubing-head spool (for an oil-well top) made from 11-in. dia. x 34-in. SAE 4130 alloy steel



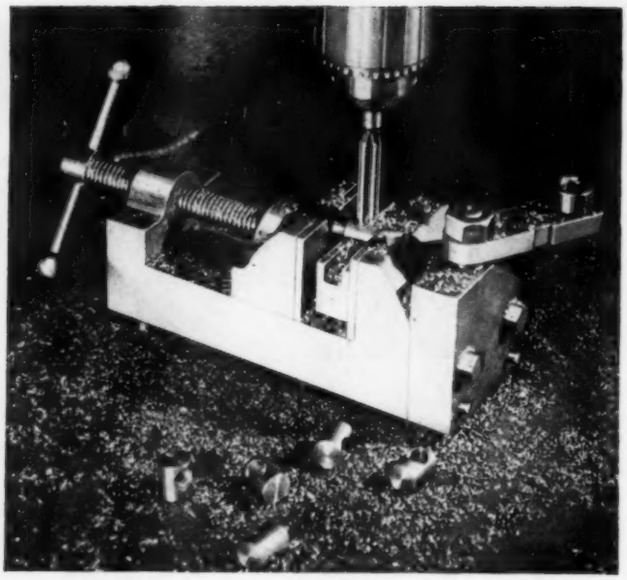
From this pulpit, at some distance, the press operator controls all press operations. Two side rams close the split die under 2000-ton pressure, and the main ram pierces and forms at more than 5000 tons (pressure has been stepped-up from the designed 5000 to 5750). Cycle on the part shown at top is about 3 min.



This "Christmas tree" or manifold for high-pressure petroleum service is typical of the forged parts produced by the press. Formerly made up of steel castings, the strength of the assembly is considerably increased by replacing cast parts with forgings



Simple but accurate drill jig is made by attaching a back plate to the end of the vise and providing a suitable work support, stop, and swinging bushing plate



Reaming can be carried out in the same fixture without removing the workpiece, by merely swinging the bushing plate out of the way or by using a suitable slip bushing

JIGS AND FIXTURES AT LOW COST

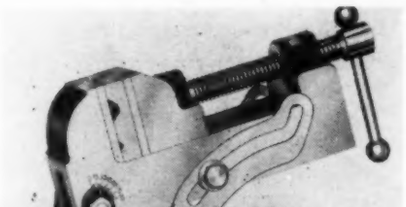
BY E. J. WEIERSTALL

Vice President, North Bros. Mfg. Co.
Philadelphia

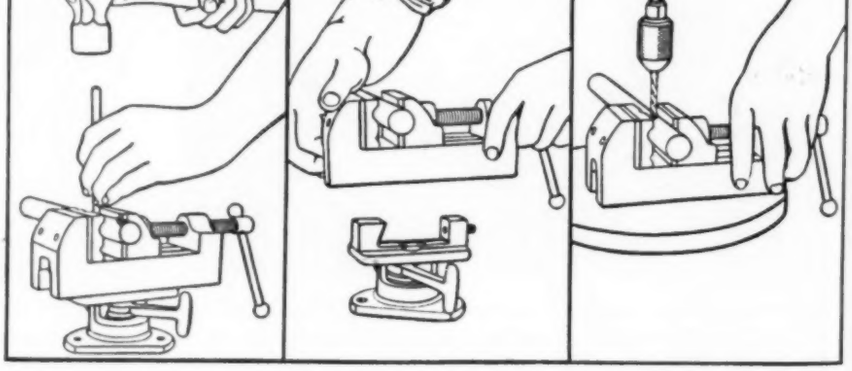
JIGS AND FIXTURES are an everyday requirement for repetitive production work. Accurately built fixtures are costly; however, they insure uniformity in machining operations and are an all-important factor in quantity production.

Conventional vises of various designs offer a partial solution to the problem of holding work for many machining operations, but their use is limited by the amount of layout that must usually be performed on an unjigged job. To overcome this difficulty, considerable use is being made of standard Yankee vises. These are accurately machined on base, both sides and front end; therefore they form the ground work for fixtures to hold work to be produced in volume. They can be easily and economically converted into jigs by adding the necessary pieces shaped to conform to the job at hand.

In addition to the economy of this procedure, the same vises can be used for regular bench work by mounting on a swivel base which is available. This base can be securely locked in place and released by a simple movement of a convenient lever, and can be had for both standard and angle styles of vise. The vise is easily removed from the base by loosening a single setscrew when it is desired to use it on a machine. V-blocks for round work are standard equipment.



Accurate angular displacement can be obtained for machine or bench work with the standard angle vise



Layout work can be performed with the vise mounted on the bench on the regular swivel base. Loosening a single setscrew allows the vise to be removed without disturbing the work and placed directly on the drill table

TALKING SHOP

Cemented Molds

MOLDS, and most cores, in the foundry of Chambersburg Engrg. are made from concrete. Castings are almost all quite large; many include accurate detail. The concrete is a dry, lean sand mix that sets well but can be broken up easily after casting. Most of the concrete is reground and reused.

Landis Tool, meanwhile, uses nothing but synthetic sand in its mechanized foundry . . . What with mechanization, air conditioning, and changes in molding materials, America's foundries certainly "ain't what they used to be."

Overnight Scrap

PINPOINT CORROSION, the result of condensation on polished steel surfaces, still exacts too great a toll. In one recent case, over-night corrosion losses on precision parts in one department ran $40,000 a year until air conditioning was installed. That cut "overnight scrap" losses to zero. If humidity and sudden temperature changes characterize your weather, and part tolerances are to tenths or less, air conditioning may save you money in finishing departments.

Batting .225

PONTIAC DIV. of G.M. has received its 10,000th employee suggestion since origination of the plan in 1942. Suggestions during the first half of 1948 were almost double those in the same period of 1947, and awards in the same period tripled. In six years, 2,254 suggestions have been accepted. A total of $114,212 in awards has been paid, making the average $50.67. Seven maximum awards of $1000 were paid.

Electric Auto-Lite reports that, in spite of approximate doubling in size in recent years, average length of service is six years. About a third of employees, (71.3% at Sharonville, Ohio), are ex-servicemen.

Anti-Barreling

INDUCTION HEATING hardens hammer ways and piston rings for Chambersburg Engineering Company. The piston rings, rolled from SAE3140, are set in a vertical oil-quenching tank, rotated past the coil automatically. They are ground afterward in the usual way. These rings, report users, give three to four times former ring life, have sufficient tension to compensate easily for wear (or "barreling") of cylinders. Former rings allowed blowby in worn cylinders after a while because they failed to expand to seal barreled walls.

Chrome

ALL MOLDS for plastics used by G.E. at Pittsfield, Mass., are chrome plated to improve surface finish and ease removal of molded parts. Coating thickness depends on expected service of the mold; coatings require only buffing before use . . . Two other new ideas on plastics are a "brushed" finish obtained by vapor-blasting and the engraving of fine detail in molds by conventional photo-engraving processes. The photo-engraving is done by a commercial photo-engraver, gets detailed designs that would be ultra-expensive by conventional machining.

Memorial

NORTON COMPANY has just published a memorial book, "Under Our Flag," dedicated to the 61 Norton men who died in service and 2480 other veterans of World War II. The greater portion of the book is devoted to charcoal portraits and biographies of the 61. Portraits, drawn by Bettina Steinke, show the men in service uniforms and at their final age—even though in many cases only old photos were available. Copies went to members of families of the deceased men, and to the 1000 veterans now with Norton. Copies are also available to veterans no longer working at Norton and to other employees.

Gin Poles

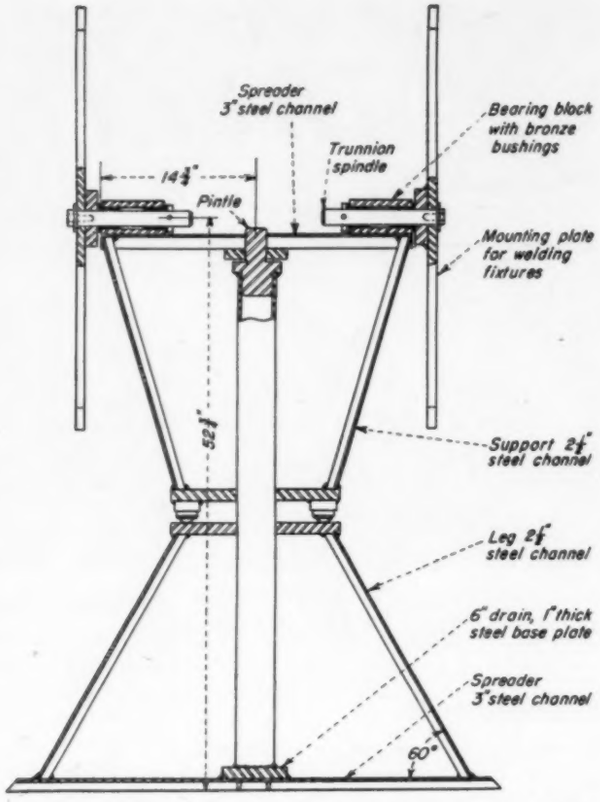
TO ERECT a big 5000-ton hydraulic press where no crane was available, A. B. Farquhar Co. used a pair of gin poles made from surplus minesweeper booms that cost only $25 each. The press was "horsed" into position under the poles by setting it on tin sheets over ordinary railroad rails greased with vaseline. Where there's a will, there's a way; add ingenuity and the way may be cheap.

Universal Machine

RECENTLY, a Latin-American prospect asked for one machine tool to handle the full range of the maker's line. The seller suggested a smaller bracket. Explanations got nowhere until the seller asked what the prospect would do if he had to carry his family into town sometimes, and carry in beef at others. Would he buy passenger car or truck? The prospect insisted he'd need both—that the truck was too big and heavy for the family, the auto too light and small for the animals. The seller applied the same principle to the problem under discussion—and the sale was made.

Frequently, old-fashioned horse sense and a good simile is a help. And the buyer who wants one machine to do many kinds of work can understand both—particularly if they save him operating expenses.

Novel welded-steel base for arc-welding operation supports three welding fixtures. These are unloaded and reloaded by helper while welding operator is working at third fixture. For comfort and safety, he stands on rubber mat at welding position



Welded-steel fixture base consists of two major assemblies. Upper unit is centered on vertical pintle and is supported on ball casters. It carries three horizontal bearings in which are fitted trunnion spindles carrying fixture mounting plates.

Stand Holds Three Welding Fixtures

Designed for rotary movement in two planes, an easily built stand simplifies welding operations and reduces welding time

BY C. W. HOLMSTROM
Chief Engineer, Indianapolis Div.
F. L. JACOBS CO.

ASSEMBLY of base units for Coca-Cola bottle-dispensing machines by arc welding is accomplished at the Indianapolis Plant of F. L. Jacobs Co. by mounting the welding fixtures vertically on special bases. Each fixture is supported by a horizontal spindle so it can be turned to bring the work into convenient welding position.

Each welded-steel base assembly holds three fixtures, and the top section can be rotated about its vertical axis to bring any one of the fixtures into welding position. During a welding operation, parts can be assembled on the other fixtures by a helper, thus permitting the welding operator to make most efficient use of his skill.

Several types of fixtures can be mounted on the three support plates of each of these stands. All three fixtures can be the same, when production requirements justify, or they can be designed to hold a variety of parts for arc or gas welding. To simplify mounting and removal of workpieces, standard toggle-type clamps are used on the welding fixtures developed at the Indianapolis plant. Each fixture has locating blocks and pads so the individual parts will be properly aligned for welding when they are clamped in position.

The steel support base consists of two welded-steel assemblies, a base unit with a centering pintle fitted in the end of a 40⅜-in. long section of 3-in. pipe, and a rotating member supported on three 1½-in. dia. Mathews ball casters spaced 120° apart under the 16-in. dia. steel plate which forms the base of the rotating member. Top of this member is formed by a three-legged spreader whose outer ends are supported by steel arms.

On the outer end of each spreader is a 3x3x6-in. steel bearing block with bronze bushings in which is mounted the horizontal 1½-in. dia., 11-in. long trunnion spindle. Each of these spindles carries on its outer end a 39-in. square, 1-in. thick steel mounting plate to which the fixture baseplate is bolted.

In use, each of the base assemblies is permanently connected to the ground lead of the welding motor - generator set, eliminating individual leads to the fixtures.

ROUND TABLE

Too Good

"Al, I've got a problem on my hands. Do you remember the young fellow they hired to run the drillpress? You know, Al, the boy that insisted on being put on a machine where he could—to use his own words—work like hell?"

"Oh, that chap! How's he doing, Ed?"

"That's the trouble; he's doing too good."

"Now wait a minute! Don't try to tell me that you are finding fault with a man who turns out his work too well!"

"That's the trouble; the fellow's performing miracles," said Ed. "The last man on that job wasn't a slouch by any means and he turned out 50 cylinder heads in 8 hr. Now this kid ups the count to 75 in a matter of three weeks. He was taken on at the same rate of pay as Connelly; now he tells me that he hasn't reached the peak yet."

"What're you worrying about then? He was hired to produce wasn't he?"

"Sure he was, and I told him when I broke him in that he should try to get 50 out as a good day's work. The fellow's making a monkey out of me, Al, and I don't know how to cope with it. Boy, we'd run our competitor out of business if the men were all like him."

"To what do you attribute his speed? Have you talked to the man at all?"

"Sure I have, Al, but he just works on as he talks, like a phonograph—the fellow is good natured and smiles, too. It seems, from what he had to say yesterday, that, ever since he was blown off the ship in the battle of the Coral Sea, his nerves have been all shot and he simply has to drive himself like mad to get over his nervousness."

"Seems to me, Ed, that the poor chap will drive himself into nervous prostration if he keeps up at this pace."

"But the strange thing is, Al, that it seems to be a cure! He told me that before he got on this job he couldn't sleep at night. Now he sleeps like a top. Before, when his neighbor's alarm clock went off—he said it sounded just like the ship alarm for attack—he'd have his shoes on and be headed for the front door when he'd be stopped by his wife. Now he doesn't hear it anymore."

"But then what's the problem, Ed?"

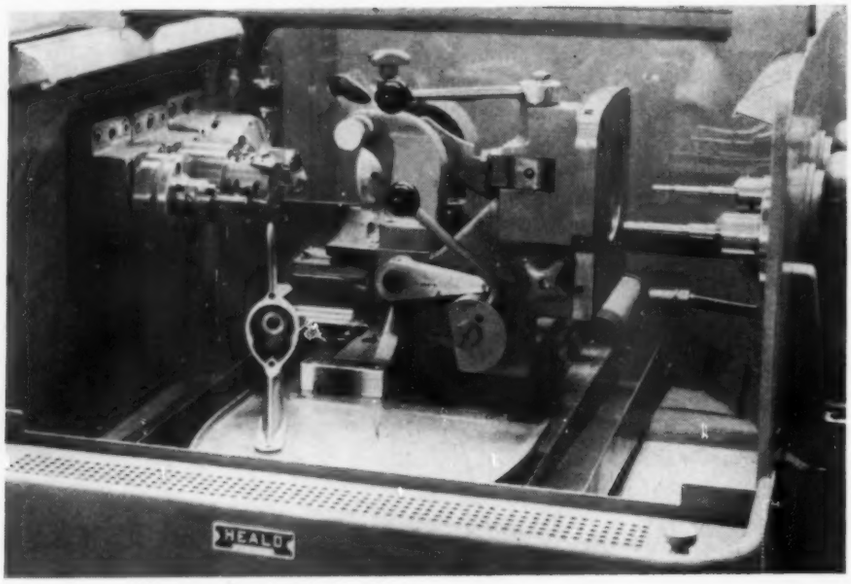
"He's the problem, Al; where's this thing going to end? We can't expect the other fellows to pile in like he is doing, can we? That'd be a good way to make nervous wrecks out of the whole bunch."

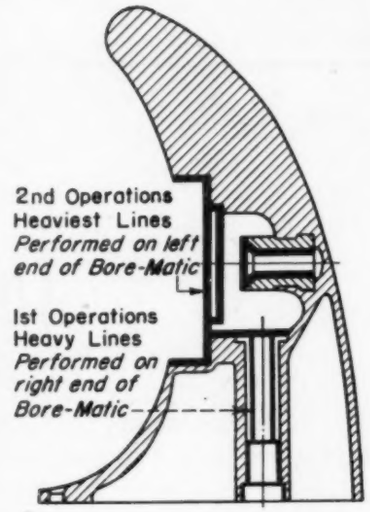
"Say, Ed, why not use him—and pay him—as a pacemaker for the shop?"

"We ought to increase his pay, but why should we stick our necks out by establishing a precedent? We'll have the big boss climbing our frame if we pay the fellow what he's really worth."

***IS ONE TOP-SPEED WORKER** likely to upset the pace of his shopmates? What can be done to get the benefit of his production without stirring up trouble among the other men? How can he be rewarded? Your answer will help others. Discussions of earlier problems appear on later pages.*

· TALENTED TOOLING

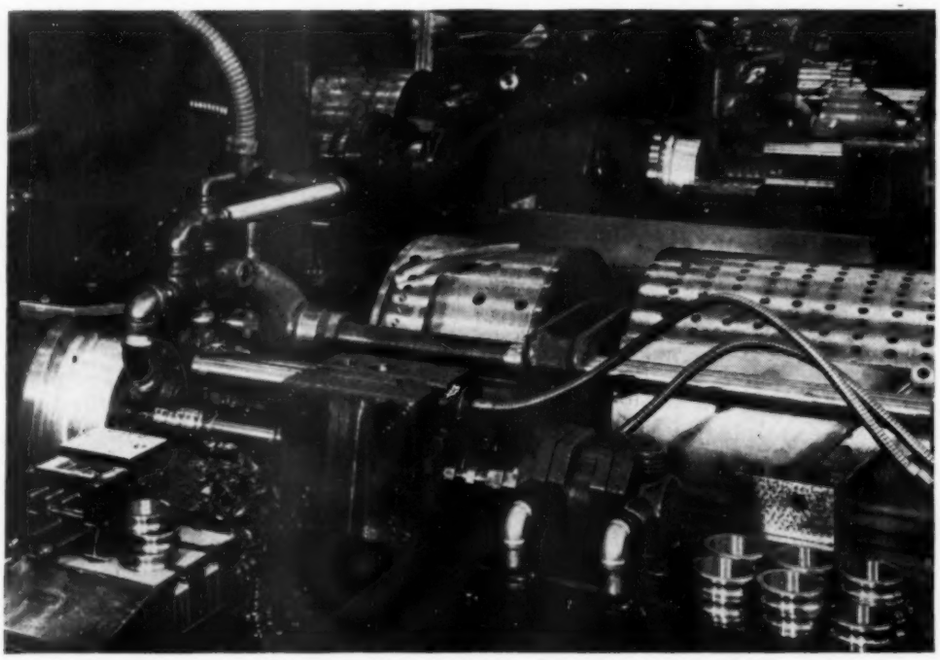




BORING CYCLE WITH 14 OPERATIONS FINISHES MOTOR HOUSINGS

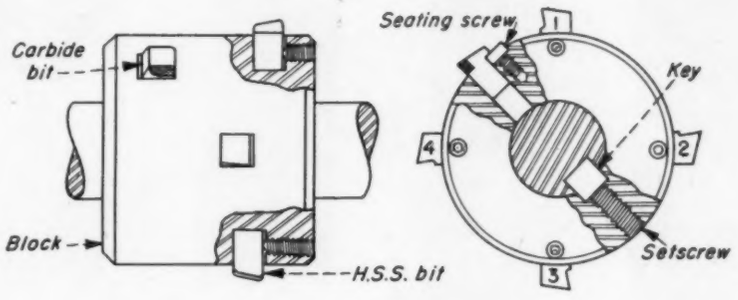
Outboard-motor gear housings are finish-bored by five spindles on two setups. Permanently sealed boring heads perform the operations outlined in the drawing as the hydraulically operated cross-slide indexes to position. The two setups are hand-clamped, but subsequent operations, except unloading, are automatic. The 14-operation cycle is completed in 80 sec. *Heald Machine Co., Worcester, Mass.*

AUTOMATIC SCREW MACHINE TURNS AND FACES BEARING RACES



Ball-bearing inner races are machined to form radii and chamfered ends three at a time. Machine in rear cuts six outer races at once. Races are cut from steel tubing on single-spindle automatic screw machines with facing and cutoff included in operation. *Cleveland Automatic Machine Co., Cincinnati, O.*

Practical Ideas



Staggered Quintet of Boring Bits Rough and Finish Pump-Body Holes

Single-pass boring that includes roughing out heavy stock and accurate finishing is possible with a tool that carries five bits in one holder. This device was designed for boring out cast-iron pump bodies to a finished 6½-in. I.D.

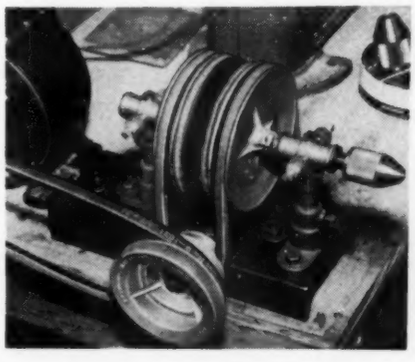
The bit-carrying block is keyed to a 3-in.-dia. boring bar in a horizontal boring machine. As an extra precaution, three holes are drilled through the block down to the top of the keyseat and three setscrews are clamped on the key.

Four high-speed-steel bits are clamped in slots in the block by setscrews through from the front of the block. The fifth bit—a carbide tool—is arranged so the setting can be made precisely. A socket-head setscrew is run into a tapped hole next to the bit slot, and the undercut shoulder on the underside of the bit rests on this. The setting is made accurately and then the other setscrew is clamped down.

The four roughing bits are aligned at 90° to each other around the block. They are marked in rotation, with each bit taking part of the roughing load. Bit 2, for instance, is 14/64 in. advanced radially from bit 1 and is also ¼ in. back from the face of the block in relation to bit 1. Each successive tool bites deeper, but back farther, than the preceding bit.

Finally, the carbide bit is placed about 1 in. behind the steel bits, where it removes a light load of only 1/64 in. for a finishing cut.

The cast pump bodies were first rough machined on their edges to provide clean metal for starting the boring cut. This, in some measure, reduced wear on the boring bits. A moderate feed was used until all bits were engaged with the work, and then it was increased to the capacity of the individual bits. *G. R. Milner, Gainsborough, England.*

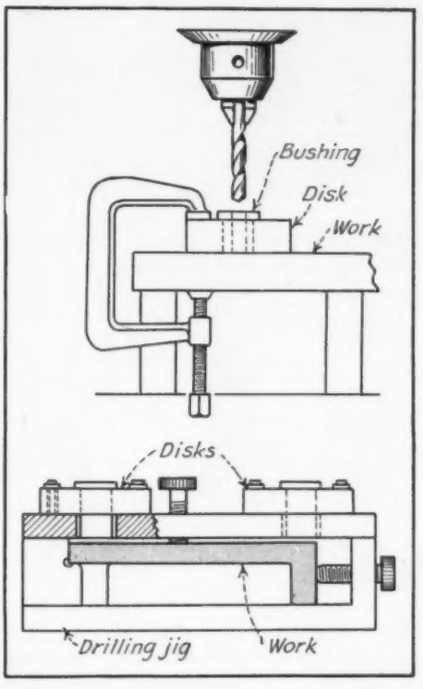


Self-Reversing Clutch Plate Drives Bench Tapping Spindle

A self-reversing drive that is ideal for small machine shops and home workshops is illustrated. It is built from a small motor, set of V-belts and sheaves and two clutches on one spindle.

Pressing work against the drive, as in tapping, engages the rear friction plate and the rear drive plate, which power the spindle clockwise. Reversing this force reverses the action of the clutching plates, and the front plates engage.

Taps or drills can be chucked in the mechanism, which is also good for special jobs that require self-reversing action. *William A. Steenberger, Spokane, Wash.*

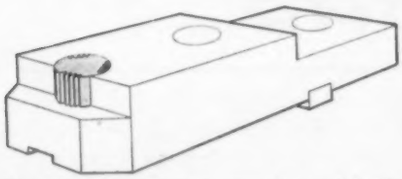


Jig Disks Locate Drills

Precisely made disk jigs for drilling accurate holes will hold a drill-press approach the performance of a jig boring machine. The disk jigs are hardened and ground tool steel.

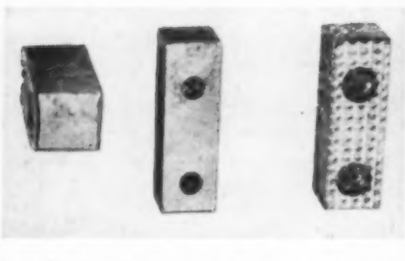
A central hole in each disk is drilled and ground accurately to a size to take drill bushings. The outsides of the disks are ground concentric with the center holes. This allows laying a number of disks out on a jig with gage blocks to attain high accuracy. The disks can also be located individually from the edge of a jig plate.

Clamping is done with C-clamps on a plate, or the disks can be located on top of a drilling jig, as in the lower illustration. Appropriate drill bushings are inserted in the disks after they have been located. *S. Framurz, Bombay, India.*

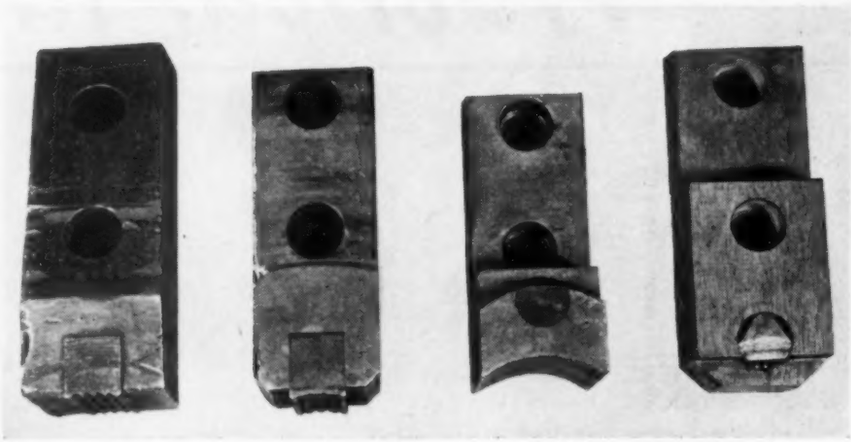


Hardened inserts in tough jaw blocks reduce wear and chipping waste

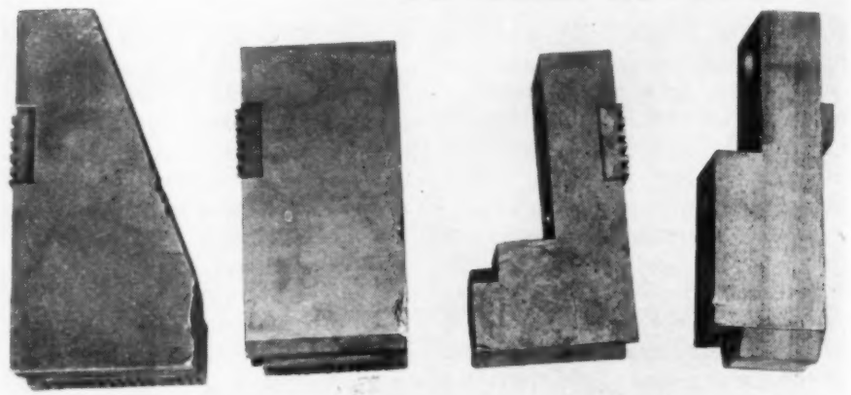
Two old jaws illustrate extremely worn condition that caused changeover to inserts



Small inserts, cut and ground to various surface shapes for various jobs, are hardened after machining. Wear life is much longer, cost is greatly reduced



Top view of blocks and inserts shows arrangement for internal and external clamping. Precise machining of the blocks is needless if holes for inserts and clamping bolts are accurately spaced



Side view of assembled blocks and inserts shows how scroll-meshing inserts are located to provide drive and clamping power from the scroll plate.

Chuck-Jaw Inserts Cut Scrap Pile And Improve Quality of Production

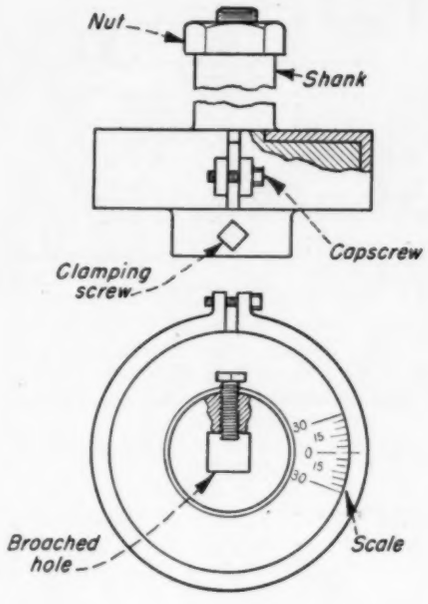
Extreme wear of the gripping surfaces on our chuck jaws was a constant problem with us until we hit upon jaw inserts. Standard universal and independent chucks were fitted with special jaw blocks that carried replaceable inserts. These inserts, cut and ground from bar stock, provide specialized gripping surfaces for various jobs at a fraction of the cost of replacing the standard jaws.

The shop-made jaw blocks are cast steel and require little machining to adapt them to a variety of engine and automatic lathes. Holes are bored in the ends to receive the inserts, while knockout holes are drilled in the under faces to aid adjustment of jaws.

One main trouble with the regular jaws was that when they were hardened to reduce wear on the grips and to hold hardened parts they chipped and broke off under any slight overload. This effect has been eliminated by the new, tough-steel blocks. Wear on scrolls and on screws and thrust bearings has also been greatly cut.

The inserts are made to specifications controlled by the types of job, material, size and heat-treatment. Flat, coarse or fine teeth can be ground on the inserts to vary the effect of the grip. Soft inserts are employed to leave finished work unmarred and hardened-steel inserts are used for heavy cuts and rough work. Positive drive has, in some unusual cases, been provided by carbide inserts.

The most effective proof that the jaws are working well is that the large pile of scrap, standard jaws has been removed and no later scrap pile has developed. The scrap loss on the small inserts is quite small, especially if the inserts are ground with three sides that can be rotated into place in turn. In addition, the original cost of the blocks was less than half that of standard jaws, and replacement has not been necessary in a year. *R. H. White, Lufkin, Texas.*



Adjustable-Angle Toolholder Positions Worm-Turning Tool

Turning a worm with a sharp helix angle is made easier with a toolholder that can be adjusted accurately to any desired helix angle. It is made in two parts—the holder itself and a shell that clamps around the holder.

The holder is turned on a lathe, the square center hole is broached and a shank rod is welded into the back end of the broached hole. The other end of the shank is threaded to take a holding nut.

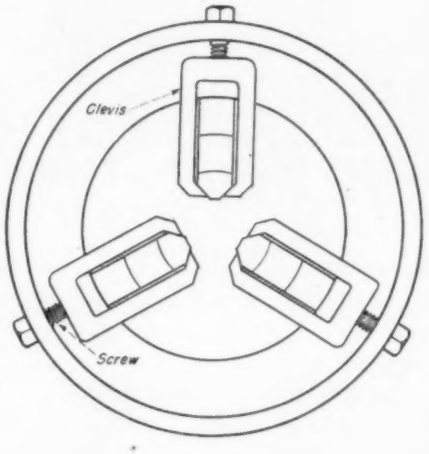
The shell is machined to fit around the holder, with its rectangular shank drilled out to admit the holder shank. The large diameter of the shell is split and two lugs are welded in place at the split. These are drilled and tapped to take a tightening screw which clamps the shell firmly on the holder.

A scale of degree readings is added to the holder, with an index mark scribed on the shell. A hole is drilled and tapped in the front end of the holder, perpendicular to the axis, for a setscrew that holds the tool inside the broached hole. The rectangular section of the outer shank is clamped in a toolpost and the holder is set at the required angle and clamped.

One thing to be remembered when the tool's top surface is turned to right angles with the thread being cut is that the included angle, if any, will change as the helix angle changes. In addition, the width of thread or groove perpendicular to the thread cross-section will change with the angle. *Albert Nivers, Waco, Texas.*

Ring-and-Clevis Setup Clamps Chuck Jaws for End Grinding

The method of regrinding universal-chuck jaws described by Chris Sorenson in a recent issue leaves a chance that the jamming that occurs when the jaws are wedged against three blocks may not allow the jaw teeth to contact the scroll properly. A system we have used for years takes up the play between jaw and scroll on each jaw individually without any interference from any other jaw.



A large ring is drilled and tapped at three points for small adjusting screws. Each screw anchors a clevis that grips the slanted slide edges of each jaw. The clamping action of the three screws hold the jaws against the outer edge of the scroll, setting up the job for internal grinding with an attachment on a lathe.

In case the chuck is to be employed for a large quantity of pieces of the same O.D., the radius ground on the jaw ends can be made exact so contact is surface-to-surface, not on a straight line on each jaw. *Martin H. Ball, Watervliet, N. Y.*

$25 (*in addition to regular payment*)

for the best PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

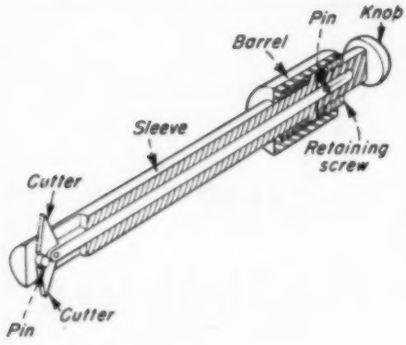
JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS — Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

60TH SELECTION
S. H. Pearson's
Pneumatic Strip Feed

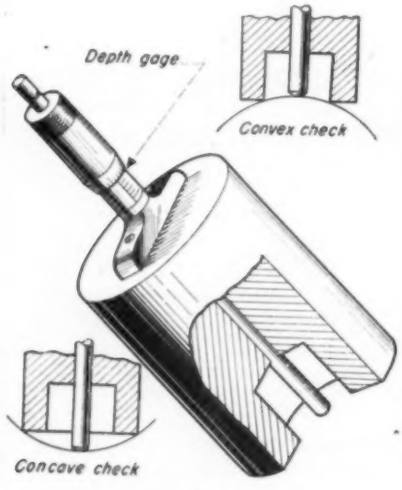


Small Cutters Deburr Blind Edges

This little gadget takes care of burrs that are inside holes or cavities in parts that can't be touched with ordinary tools.

The center shank and the barrel are pinned together at the knob end of the device. Normally the spring exerts pressure to pull the two small cutters into the sleeves, but these can be pushed out so they expand—like scissors—to cut burrs. The barrel is gripped between two fingers and the knob is pushed with the thumb to extend the cutters.

At the lower end, a pin through the end of the slotted-out sleeve guides the cutters apart when the knob is pushed. *W. Smele, Bristol, England.*



Depth Gage and Ground Block Measure Curved-Surface Radii

Spherical sections, either concave or convex, are difficult to check, especially if they are only partial sections or there are no measuring devices available for that size. The composite tool illustrated will give accurate measurements of any regular spherical surface.

The body is turned and ground from tool steel to accurate dimensions. Although any convenient diameters may be ground, the calculating will be simpler if the edge diameters are in even inches.

A standard depth gage is fastened to the block by countersunk bolts in blind holes. This allows the gage to be removed for normal use and insures that, if the block top is accurately ground, the elements will stay matched.

The center hole in the block is a slip fit for the gage rod, which is rounded off at the end to a radius sharper than any concave radius to be checked. The gage is calibrated by grinding the bottom of the block off exactly perpendicular to the vertical edge at such a point that when the rod ends flush with the block, the scale reading will be in the center of the two extremes, or exactly on the half-inch reading of a 1-in. scale.

The formula for finding the radius of a given curve is:

$$R = \frac{D^2}{8M} + \frac{M}{2}$$

. In each case the proper D must be applied. This will be the diameter of the inner edge for a convex surface, and the outer diameter for a concave surface. The quantity M is the gage reading, which will be down from the center for a concave radius, and up for a convex one.

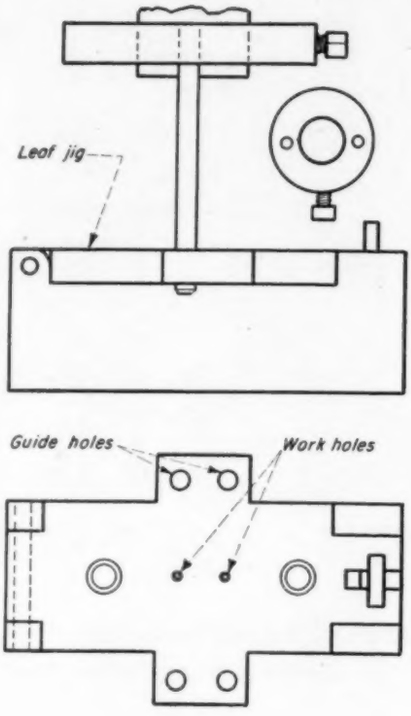
Thus, if the outside diameter is 4 in. and the reading is 0.1 in., a concave radius would be:

$$R = \frac{4^2}{8 \times 0.1} + \frac{0.1}{2} = 20.05 \text{ in.}$$

The inside diameter might be ground to 3 in. with the above size for the outside edge diameter. If the spherical shape were convex with the same reading (in the opposite direction), the radius would be:

$$R = \frac{3^2}{8 \times 0.1} + \frac{0.1}{2} = 11.30 \text{ in.}$$

Ray Cafiero, Brooklyn, N. Y.



Jig Guides Align Small Drill

Broken drills were something we couldn't avoid on a job that called for two small holes. The jig was held by hand under the drillpress spindle for the operation, but any slight variation in alignment meant that the drill would snap.

Instead of clamping everything down, which would have lost us time, we made our jig plate differently. Two "ears" were added to the top plate of the jig. These were drilled with two holes opposite the positions of the smaller holes to be drilled in the part. A large collar was made with drill-rod extensions that mated the ear holes.

When the collar was clamped around the quill of the drill, the long drill-rod extensions lined up the center of the spindle, and the small drill, with its exact position over the jig. The jig was left free to be moved by hand under the spindle. With the chamfered extensions projecting farther than the drill, the work could be aligned perfectly before the drill entered the jig. *H. Moore, Kirstall, Leeds, England.*

NEWS OF METALWORKING

New Machine Tools Feature British Show

LONDON (McGraw - Hill World News)—Britain's determination to capture a large segment of the export market for machine tools was clearly evidenced at the 1948 Machine Tool and Engineering Exhibition at Olympia Aug. 26-Sept. 11.

The Exhibition was the largest ever held in England and was the first since 1934. One-quarter of the exhibits were or foreign makes, mostly American shown by British sales agents or manufacturing affiliates. There was also a good representation of the best Switzerland, Belgium and France had to offer.

Many of the British tools were entirely new and there were several unorthodox designs. The major impression gained from the display was British progress in general design and performance. Clean-line styling and the incorporation of electronic controls were outstanding.

George Strauss, minister of supply, in his opening speech reiterated the government's appeal to the machine tool industry to strive toward the export target (currently around $80,000,000, or 60% of output) and emphasized the special need to increase exports to hard currency areas. He estimated 1948 production will go above $1,200,000,000, which is 20% above 1947 production and five times the 1935 value.

Machine-Tool Trades Association President J. Holland Goddard voiced the industry's growing realization that the government policy must be accepted and that builders must disappoint the home market somewhat in favor of cultivating future export markets.

The British are still concentrating on general-purpose machines which are those most in demand at home and abroad. Builders are still running at maximum capacity with fairly long delivery dates.

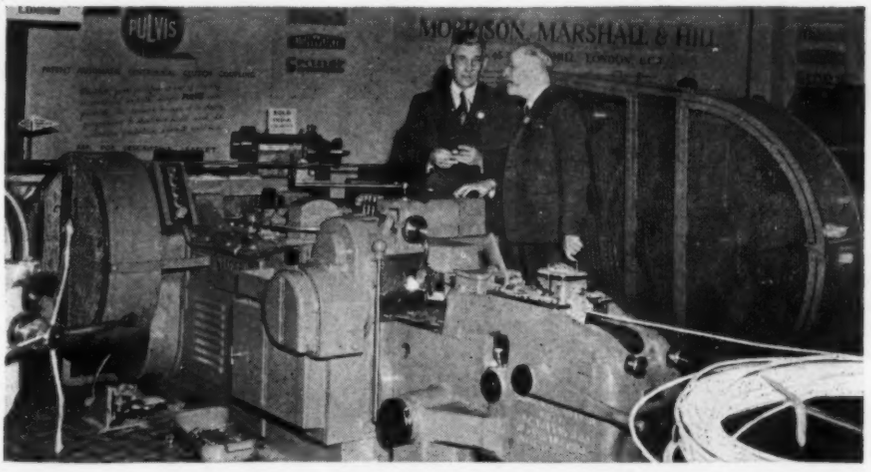
There were about 200,000 sq. ft. of stand space and the exhibits were assessed at more than $120,000,000. Every machine was in operation on opening day.

Speaking at the inaugural luncheon, Mr. Goddard referred to the urgent need to secure as quickly as possible, and on the soundest economic basis, a return to security, a raising of the general level of living throughout the world, and ultimate prosperity. He mentioned the repeated emphasis laid on the fact that increased production is the key to this recovery.

"Machine tool men of the world," Mr. Goddard said, "need not be too modest about the part they play in the progress to recovery."

Commenting on the aim of the Exhibition, he said that one of its objects was to promote the sale of ma-

(Cotinued on Page 136)



Feature of George H. Alexander Machinery Ltd., exhibit is the new Waterbury long-stroke high-speed heading machine equipped with Hogue drawing attachment made by The Ajax Mfg. Co. Machine will produce 3 in. by ¼ in. bolts at rate of 175 per min. J. Schaeffer, vice president of Waterbury Farrell Foundry & Machine Co. is seen here (left) with George H. Alexander, managing director of George H. Alexander Machinery Ltd., British agents

American representatives on the stand of Alfred Herbert Ltd., Coventry, Col. C. W. Clark, D.S.O., M.C., director, Alfred Herbert Ltd.; C. B. De Vlieg, president De Vlieg Machine Co., Mr. Felix Harmer, Alfred Herbert Ltd.; Edwin Fellows, foreign sales manager, Fellows Gearshaper Co.; J. M. McNeill, foreign sales manager, Landis Machine Co.; R. A. Smith, De Vlieg Machine Co.; H. Lowe, exhibition manager, Alfred Herbert, Ltd.

U. S. MACHINE TOOL MEN, BRITISH

Giddings & Lewis 570T horizonal borer was one of the largest machines shown. Ten motors are provided, with comprehensive electrical controls from fixed panel and portable remote control unit. Working surface of table is 60 in. by 140 in. and cross travel 120 in. Main spindle is 7 in. in dia. Here on the operator's platform Curt Rockwell (left) managing director of Rockwell Machine Tool Co. Ltd., the company's British agents, is seen with Ralph Kraut, president and A. K. Gallimore, chief engineer of Giddings & Lewis Machine Tool Co.

On one of the Alfred Herbert stands W. Core, and E. R. Schofield, directors, Alfred Herbert Ltd.; Alexander Keller, vice president, Pratt & Whitney; Felix Harmer, Alfred Herbert, Ltd. A. Keller die sinker is seen in center of the group

A. W. Foerster, managing director, Cincinnati Milling Machines Ltd., Birmingham, C. F. Roby, vice president and assistant general manager, Cincinnati Milling Machine Co., U.S.A.; J. B. S. Gabriel, director, C.M.M. Ltd., Birmingham, and vice president of Machine Tool Trades Association; and W. W. Tangeman, vice president and general manager Cincinnati Milling Machine Co., U.S.A., are shown on the Cincinnati stand

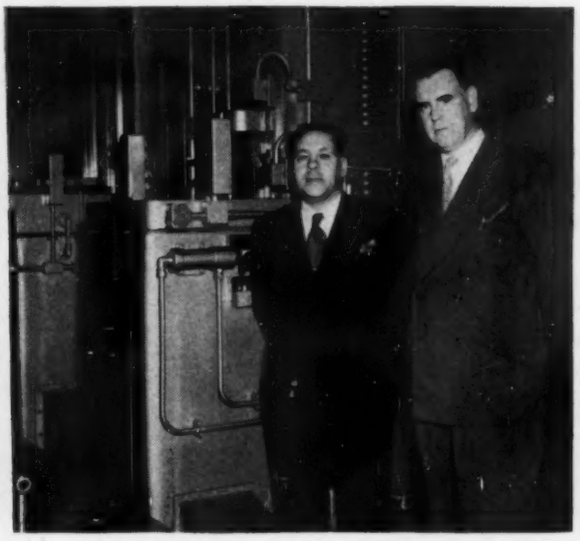
E. Shackleton, Burton Griffiths & Co., Ltd. (manager Manchester office); H. W. Smith, European representative, National Acme Machine Co.; R. R. Rhodehamel, general sales manager, National Acme Machine Co. Machine seen behind group is the 2⅝-in. R. B. six-spindle National Acme Gridley with general tooling. Company is also showing the Namco T.R.-I Roll-Matic thread rolling machine

chine tools but that another important one was to give engineers an opportunity of obtaining guidance for the forward planning.

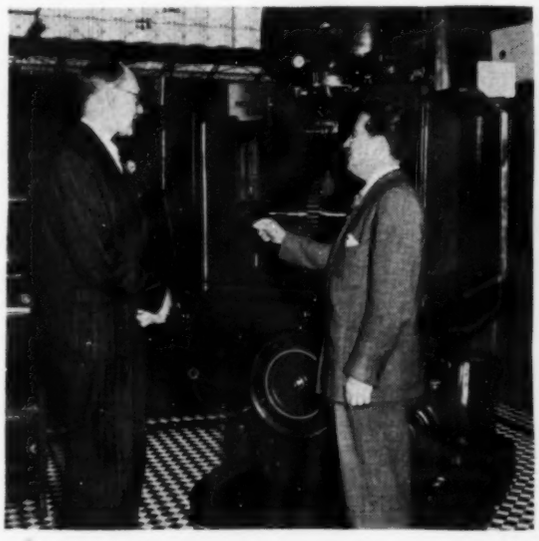
Mr. Strauss, taking up the controversal matter of exports, emphasized the difficulty in striking a balance between British need to export machines to pay for the food and raw materials needed and the essential requirements of the home industries. In striking the balance, the minister said, he looked to the Machine Tool Advisory Council for their advice and assistance. He contended that in sending machine tools abroad Britain was also helping to ensure a higher degree of prosperity and following the policy of "maximizing the flow of world trade between all countries."

OFFICIALS AT OLYMPIA SHOW

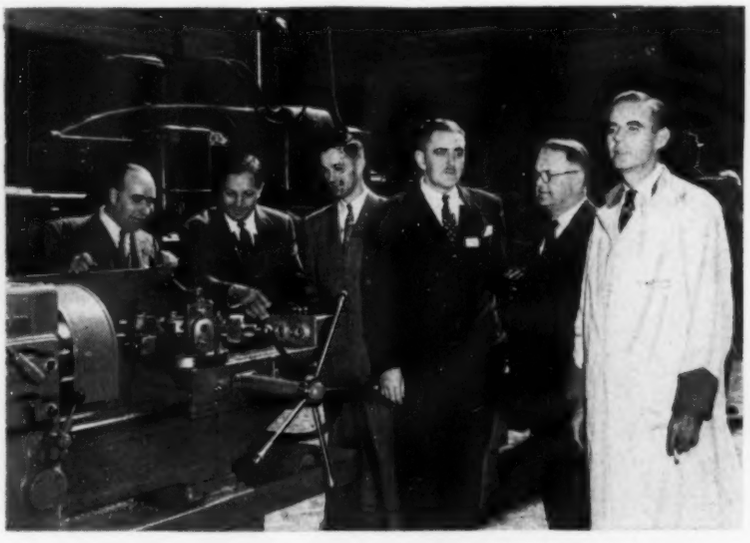
Feature of Rockwell Machine Tool Co., Ltd., display, British agents for Monarch Machine Tool Co., is the Monarch Shapemaster engraving lathe shown here with Steven Neff, sales engineer; Wendell E. Whipp, chairman, Monarch Machine Tool Co.; C. Rockwell, managing director, Rockwell Machine Tool Co.; and Paul Howkins, sales engineer, Monarch Machine Tool Co. Other Monarch machines shown were the Monomatic with air gauge tracer for rapid production duplicating; also the 10 in. sensitive precision toolroom lathe and 16 in. toolroom lathe, both equipped with air gauge duplicating device



T. P. C. King, managing director, Lapointe Machine Tool Co. Ltd., Edgware, London, England (left) with J. J. Prindiville, president Lapointe Machine Tool Co., U.S.A., standing in front of two of the new British-built Lapointe broaching machines, the vertical pull-down machine and the vertical surface broaching machine. The H.P. 5 horizontal is also on the stand



J. B. S. Gabriel, chairman of Charles Churchill & Co., Ltd., agents for the National Broach & Machine Co., discusses features of the Red Ring 24-in. gear shaper with W. S. Praeg, president of National Broach, on the Churchill stand



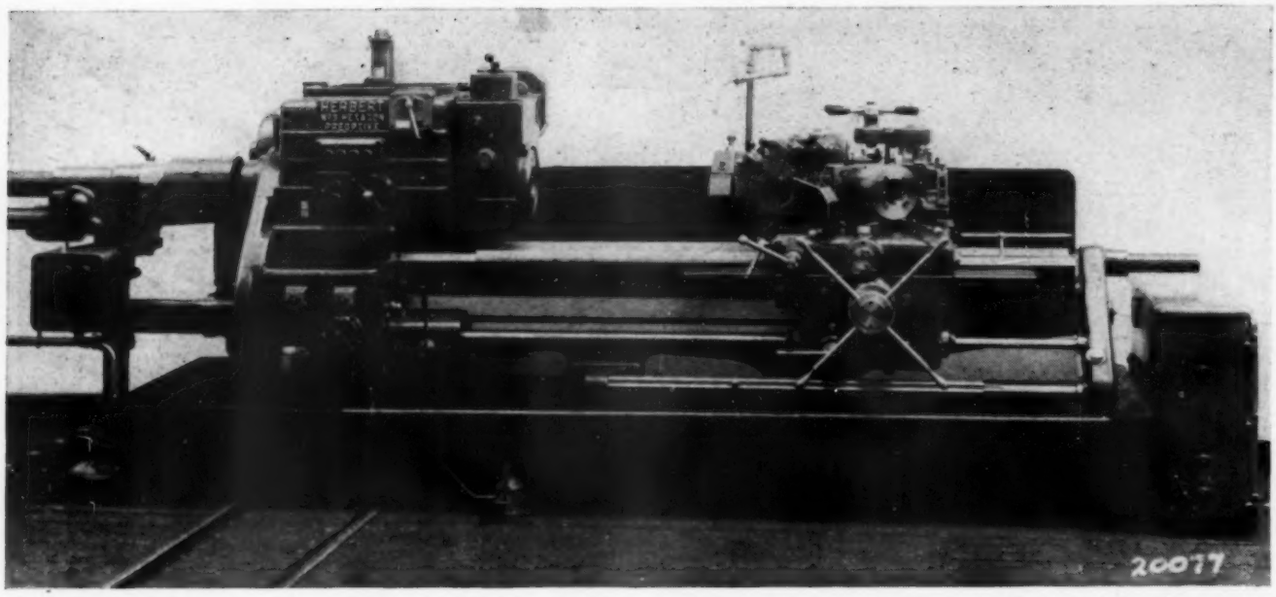
Warner & Swasey electronic turret lathe is center of interest for S. W. Perkins, sales manager A. C. Wickman, Ltd.; Noble Clark, export manager, Warner & Swasey Co.; W. F. Mericle, director of export, The Hydraulic Press Manufacturing Co.; R. Dixon, chief engineer, A. C. Wickman, Ltd.; G. R. Marsh, sales director, A. C. Wickman, Ltd.; and Frank Moran, vice president, Carlton Machine Tool Co. Carlton radial drill is behind them

---

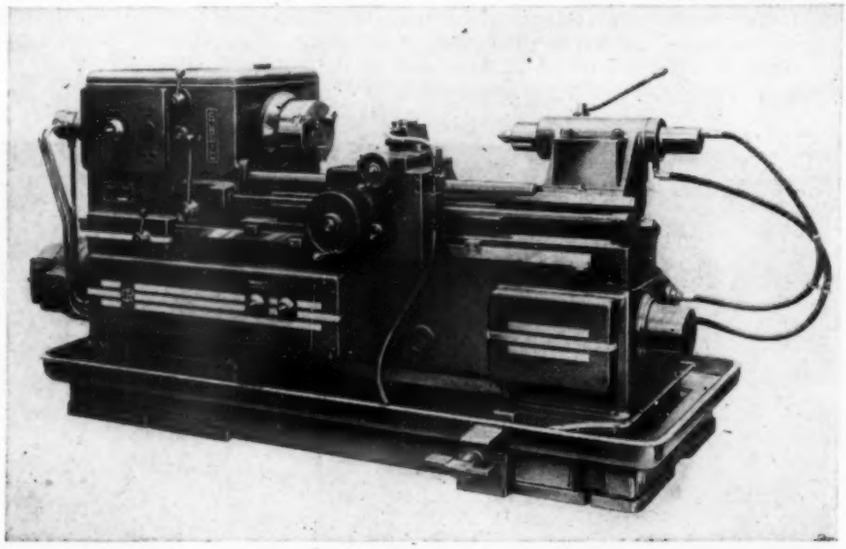
Woodworking machines were included, also presses and sheet-metal-working machines, forging equipment, diecasting and plastic molding machines, some welding units, electrical equipment and many small tools.

Another feature of the show was the large number of copying machines, which take much of the skill out of exacting contour work. Mechanically the machines reflected the insistent demand for equipment which will permit the most to be made of sintered carbides and other improved cutting materials in the search for increased productivity and lower costs. Speeds in many of the machines were exceptionally high. Many hydraulic units were on display.

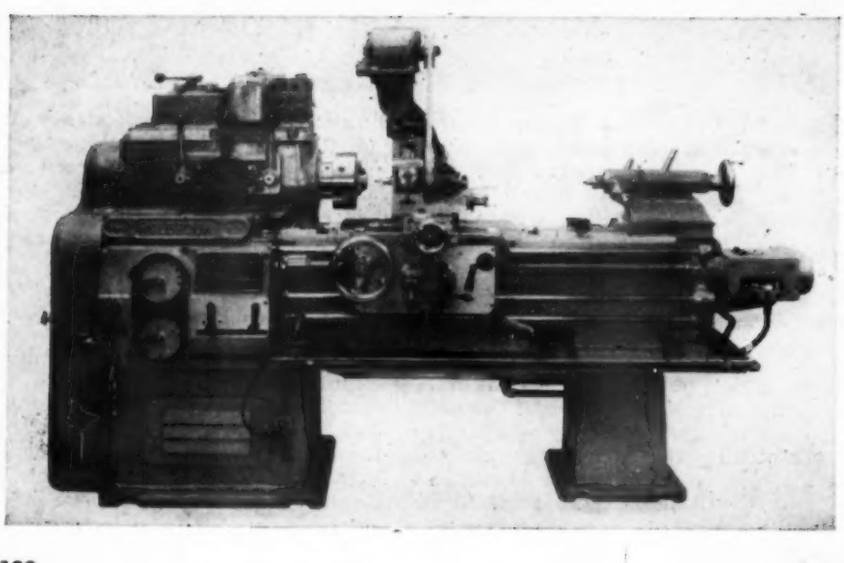
British Machine Tool Exhibition Reveals



No. 3 Hexagon Preoptive Turret Lathe exhibited by Alfred Herbert, Ltd., Coventry, incorporates the latest development of the firm's Preoptive headstock, providing eight speeds which together with the two-speed motor control, gives 16 speeds forward and reverse, ranging from 13 to 1000 rpm.

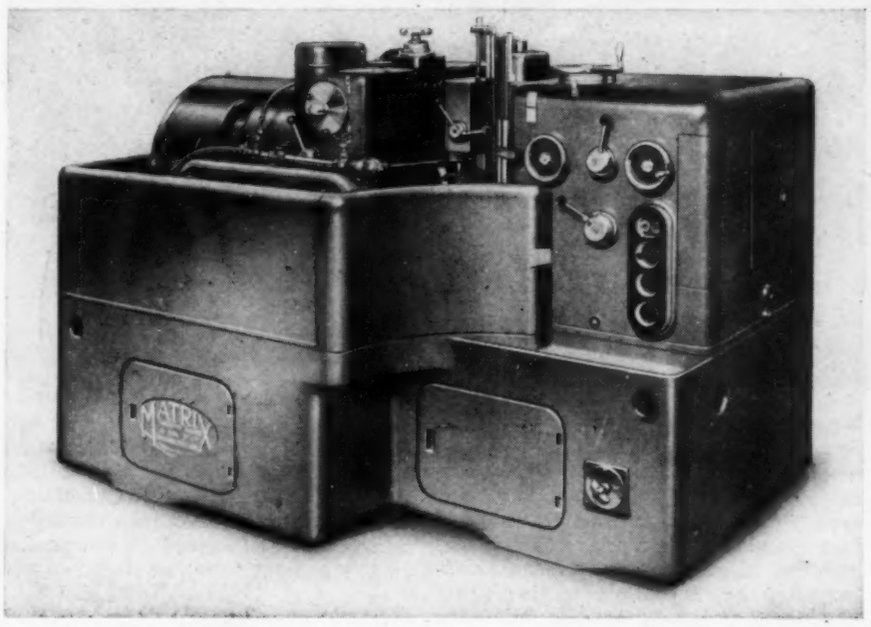


Semi-automatic hydraulic lathe, introduced by Churchill-Redman, Ltd., Halifax, will swing 12 in. dia. over the bed, 6 in. over saddle and will admit up to 30 in. between centers

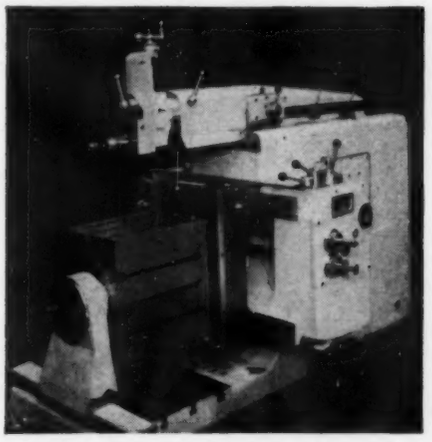


Variation of the pitch of threads cut or milled in plastic molds to compensate for shrinkage is accomplished in the Holbrook D. 15 mold-making lathe by means of a device fitted to the end of the leadscrew and actuated through change gears. The lathe was exhibited by the Holbrook Machine Tool Co., Ltd., Martin Street, Stratford, London

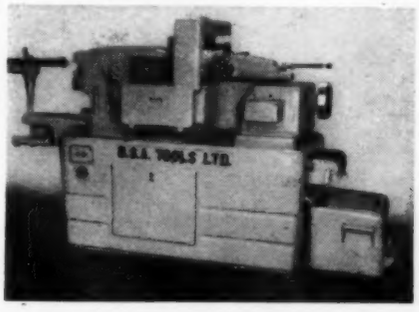
Drive to Produce Most Modern Equipment



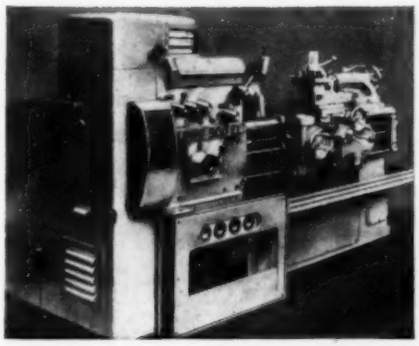
Continuous spiral rack formed in the working surface of the grinding wheel is incorporated in the new Matrix No. 40 high-speed gear-grinding machine exhibited by Coventry Gauge & Tool Co., Ltd. Gear teeth having a maximum length of 4 in. in work up to 6 in. dia. and quantities of gears of 16 d.p. and finer can be ground simultaneously from the solid



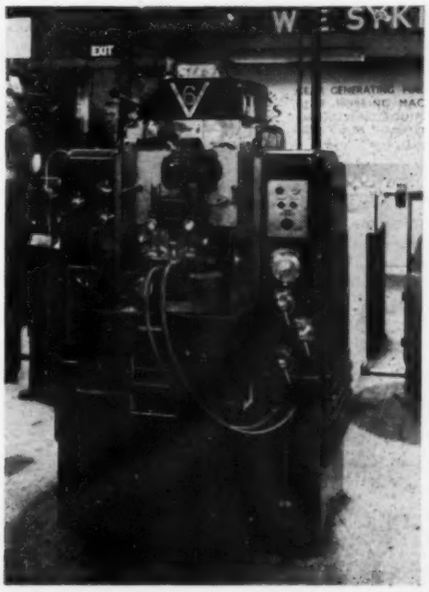
New C.V.A. 20-in. hydraulic shaper has fixed cross slide of extremely deep section, with the table carried on a saddle, which allows a swiveling arrangement for the table to be incorporated. Both ram and table feed are hydraulically operated, providing a stepless range of feeds and speeds. Tool is automatically lifted on return stroke. E. H. Jones (Machine Tools) Ltd., The Hyde, London, exhibited the shaper



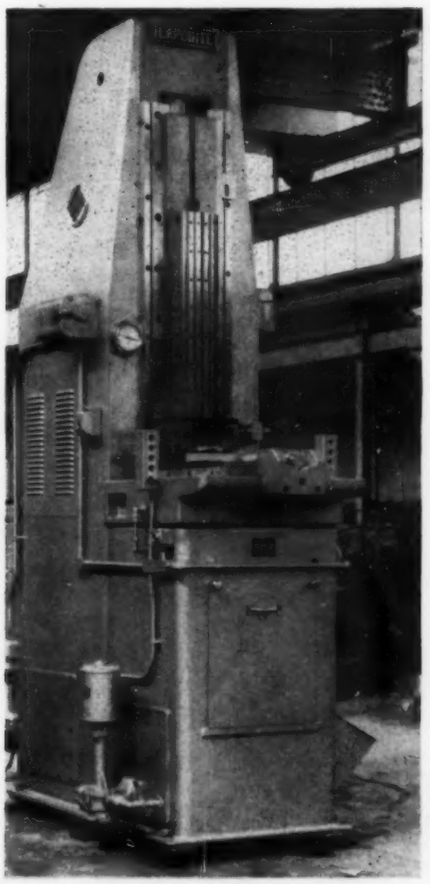
Better chip clearance is obtained by placing the front camshaft entirely at the headstock side of the cross-slide in the B.S.A. No. 88 single-spindle automatic screw machine exhibited by B.S.A. Tools, Ltd., Mackadown Lane, Marston Green



Uniform cutting speed when facing or taper-turning is automatically maintained in the EL-500 lathe, made by Progres Industriel, Brussels, and exhibited by Soag Machine Tools, Ltd., Juxon Street, London



High-precision instrument gears are produced by this V. 6 high-speed gear generator introduced by W. E. Sykes, Ltd., Staines, Middlesex. External and internal spur and helical gears can be handled up to 6 in. for the former and 4 in. for the latter. A face width of 1 in. is maximum. A special attachment permits cutting racks up to 10 in. long



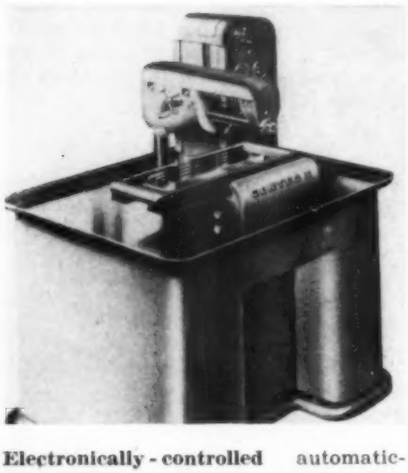
First Lapointe broaching machines to be built in Britain are exhibited by Lapointe Machine Tool Co., Ltd., Church Way, Edgware, Middlesex

Optical Aids Utilized on Machines at Olympia

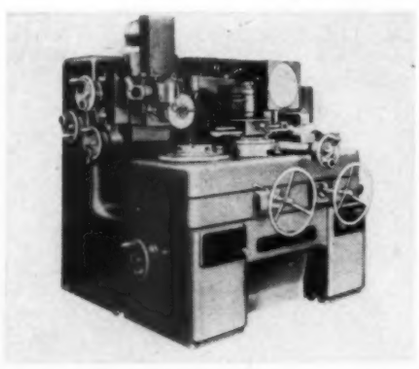
New model H. 52 Tarex automatic screw machine, exhibited by Dowding & Doll, Ltd., Greycoat Street, London, closely follows the earlier design of the Swiss firm's machines but has been developed to handle both bar and chuck work

Single plunger, depressed to five different depths by adjustable dogs on the table, controls the traverse of the table during the automatic two-way cycle of the Victomatic 26-in. manufacturing milling machine built by Victoria Machine Tool Co., Ltd., and exhibited by B. Elliott & Co., Ltd., Willesden, London

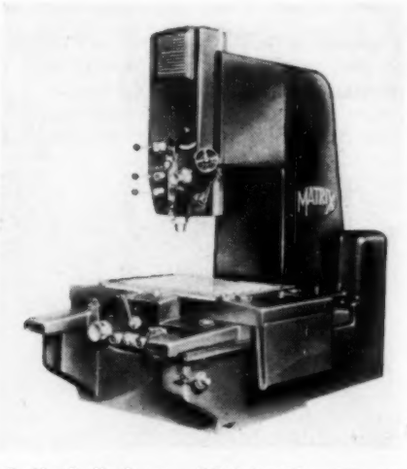
Internal spur and helical gears up to 24-in. dia. are produced in the new JHSS-60 Maag internal gear-grinding machine, distributed in England by Burton Griffiths & Co., Ltd., Mackadown Lane, Marston Green, near Birmingham. The Swiss machine operates on the generating principle



Electronically-controlled automatic-cycle milling machine for mass production of small components is exhibited by the Central Tool & Equipment Co., Ltd., Church Terrace, Richmond, Surrey



Watch the screen, not the work, when profiling and copying with the Genoptic Profile Grinder, developed by Taylor, Taylor & Hobson, Ltd., Leicester. A large optical-comparator projection screen is placed at eye level



Optical jig-borer, Matrix No. 50, capable of boring up to 9 in. dia. or drilling holes 1.5 in. dia. is built by Coventry Gauge & Tool Co., Ltd., Fletchamstead Highway, Coventry

***PUSHER-TYPE** flying automobile is tested in wind tunnel before production is started by Aerocar, Inc., of Longview, Wash. Wings fold back and the flying component can be detached to become a compact trailer, wheels of which are housed in the leading edge of the wings*

Spade Work Necessary to Get ECA Machine Tool Orders, Bryant Says

NEW YORK—A lot of spade work must yet be done before the U.S. machine tool industry can expect much business from European countries through ECA, according to A. G. Bryant, president National Machine Tool Builders' Association, who returned from Britain and Europe on the Queen Mary on September 13.

Mr. Bryant talked with ECA officials in Paris and in other countries. He also visited machine tool dealers and importers and government officers in Britain, France, Belgium and Holland. The object of his journey was to take a look at the Marshall Plan in action and to size up prospects for European imports of American machine tools within the ECA framework.

He found that:

1) European countries are slow to formulate recovery programs (which involve machine tools) as contrasted with relief measures under ECA.

2) ECA top men are greatly concerned over this slowness of recovery planning, because next spring Congress will demand proof that Europe is progressing toward recovery before further appropriations are granted.

3) Propaganda has been spread in some countries that America is seeking to use the Marshall Plan to flood Europe with U.S. machine tools.

4) Some ECA officials believe that U.S. machine tool companies are so loaded with business that deliveries would be badly delayed; hence orders should be placed with builders in other countries.

5) European machine tool industries are convinced that they can supply the requirements of ECA nations without resort to U.S. machine tools.

6) ECA men in Paris believe that U.S. war surplus machine tools are available and should be sold to ECA-participating nations in preference to new machine tools.

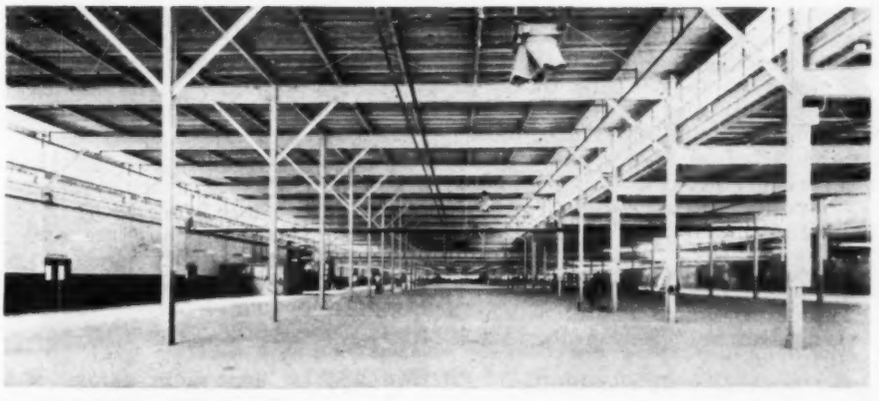
Mr. Bryant, who was accompanied on many of his visits by Tell Berna, general manager NMTBA, stressed in his talks with ECA officials that machine tool users in Europe should be allowed freedom of choice in selecting their machines. If the user can make out a good case for purchase of a U.S. machine on the basis of cost-cutting and higher productivity, he should be permitted to buy it, even if it should cost more than a machine built elsewhere.

But there is a serious lack of information in Europe about the greatly improved performance of American machines, declared Mr. Bryant. A big selling job must be done by American builders and their agents. Emphasis must be put on the superior job done by general-purpose machines made by U.S. builders. Companies here always will get the mass-production, special purpose machines needed by European users.

Attempts to import war surplus machines into European countries would waste precious time and would get nowhere, Mr. Bryant pointed out to ECA officials. He told them that war surplus stockpiles had been picked clean, that only a small number of miscellaneous machines remain. European buying missions would discover, as some already had, that war surplus machines here are unusable and obsolete. They then would refuse to buy. Moreover, poor performance of any surplus machines which might be bought by European countries would scare off buyers in the future and tend to push U.S. builders out of the European market in the future.

Mr. Bryant stressed the fact that U.S. machine tools, now available in quantity, would serve to get European industry back on its feet quickly. These machines can be delivered with speed and are at least one-third more efficient on the average than the same tools turned out during the war. He said that U.S. machines should be given the job of rebuilding the European economy wherever they can do it faster and better than other makes.

Greatest barrier to ECA orders for U.S. machine tools, in Mr. Bryant's opinion is an uninterested attitude on the part of officials of individual governments and of ECA. The feeling is that there is greater need for other imports than of U.S. machine tools.



SONS AND GRANDSONS *of original founders of the Norton Co., Worcester, Mass. (top photo): John Jeppson, assistant secretary and superintendent of the new plant; Aldus C. Higgins, chairman of the executive committee; George N. Jeppson, chairman of the board, and Milton F. Higgins, president, attended the dedication of the grinding wheel plant (bottom photo). One of the cat walks in the view of the west section of the plant can be seen in the middle foreground. Cafeteria, hospital, washrooms and production offices are along the west side of the building. The plant cost $4.3 million*

Detroit

CONTINENTAL SHOWS NEW AIR-COOLED ENGINES . . . MILITARY CHANGES EXPECTED TO MODIFY TOOLING . . . OUTPUT SPOTTY

Unveiling by Continental Motors Corp. of a new line of air-cooled engines ranging in capacity from 125 to 1,040 hp., was a major technical development of the month at Detroit.

The distinctive feature of these engines is that they are built on two basic cylinders. Aside from blocks, cranks, and camshafts, they consist of identical components. The air-cooled jobs weigh only about a third as much as the liquid-cooled engines they are designed to replace in military vehicles, and occupy on fraction of the formerly-needed installation space.

Army Ordnance started this development going about five years ago. The initial models shown at Detroit were produced with military applications in mind. But it appears obvious that if military use proves the new engines practical, commercial installations in trucks, buses and perhaps farm implements, will follow. There are quite evident manufacturing economies possible in mass production.

Tooling Held Up

Tooling for the new engines has not yet begun, and it will not begin, as matters now stand, until the Ordnance Department's interest is translated into purchase orders. But military people are so impressed with the new powerplants that some early action appears logical.

One more innovation in military vehicles which may affect forthcoming tooling requirements in specialized areas of development is a contemplated changeover from 6 volt to 24 volt electrical systems. The objective is to provide more current for the various accessory components of the vehicles—notably radios—and to increase other capacities.

In addition, forthcoming military specs call for far more thorough waterproofing of electrical parts than ever before. The requirements are fairly stringent on this point, so development work may go forward apace before too long.

Long-Term Project

This is in the nature of a long-term project, it appears, rather than one for the immediate future. However it seems well standardized at this point, and some educational orders are reportedly already placed.

Tooling sources are receiving substantial numbers of inquiries at this time many report, but the actual orders which follow quotations seem to be decidedly small. Evidently a large number of companies are fishing around, making longer-range plans, getting themselves in readiness for any moves required by a changing situation—such as a turn in the economy to the point where new models and dress-ups might have to make an appearance in autos and other lines.

CONVERTIBLE BROUGHAM, which Hudson believes is the most advanced convertible conceived for assembly line production, will be displayed in advance showings in a selected number of cities this month. All models are available with Hudson's new Drive-Master automatic transmission

Willys Operating Again

Willys-Overland Motors, Inc., has resumed output of jeep station wagons and station sedans after a 2-month shutdown, during which body dies, jigs, and fixtures were transferred from Hayes Mfg. Co., Grand Rapids, to Briggs Mfg. Co., Detroit. Larger body-building capacity of Briggs is expected by W-O to make increased production schedules possible—although the criterion for output in the months ahead, as in the past, will be the availability of sheet steel.

Postwar production expansion at Nash Motors Division now includes a new assembly plant at El Segundo, Calif. This plant will begin assembling 1949 models late this year to supplement the output of the company's Wisconsin plants.

Altogether, the division's facilities since the war have been expanded to build about 250,000 cars annually. But materials and parts shortages up to now have kept actual Nash production below the 1000 car-a-day maximum output. The highest daily production so far has been 728 cars, put out shortly before the plant closed for the new model changeover.

Another new automobile assembly plant is the unit of Studebaker Corp. of Canada, at Hamilton, Ont. The first car rolled off the line on Aug. 18 amid festivities attended by company officials, Canadian business men, and employes. The one story building covers about seven-and-a-half acres and is readily accessible to rail and water transit serving principal Canadian car markets.

The total new car dealers' order backlog as of July 1 was approximately 7.3 million units. That is a figure obtained in a recent survey conducted by the National Automobile Dealers Association. N.A.D.A. estimates that 26 months will be required, at current automobile production rates, to fill back orders alone. Coupled with the large number of old cars and the rapid population growth, this backlog puts the industry no nearer the point of meeting demand than it was at the end of the war, the association believes.

Steel Closes Plants

Automobile production moved into September to the discordant note of another short shutdown of General Motors assembly plants. They stayed closed the Friday before and the Tuesday after Labor Day, due to lack of sheet steel. The long holiday weekend kept output down around the 100,000-mark for each of the two weeks affected. Thereafter, some gains were in the cards, although there is no general expectation that September will see volume move into substantially higher ground than the 110,000-115,000 range the industry has adopted as its maximum plateau in recent months.

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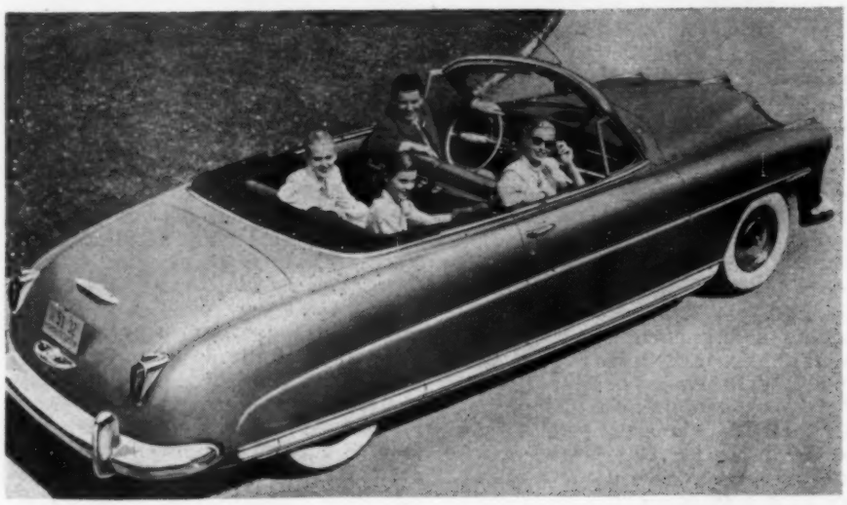

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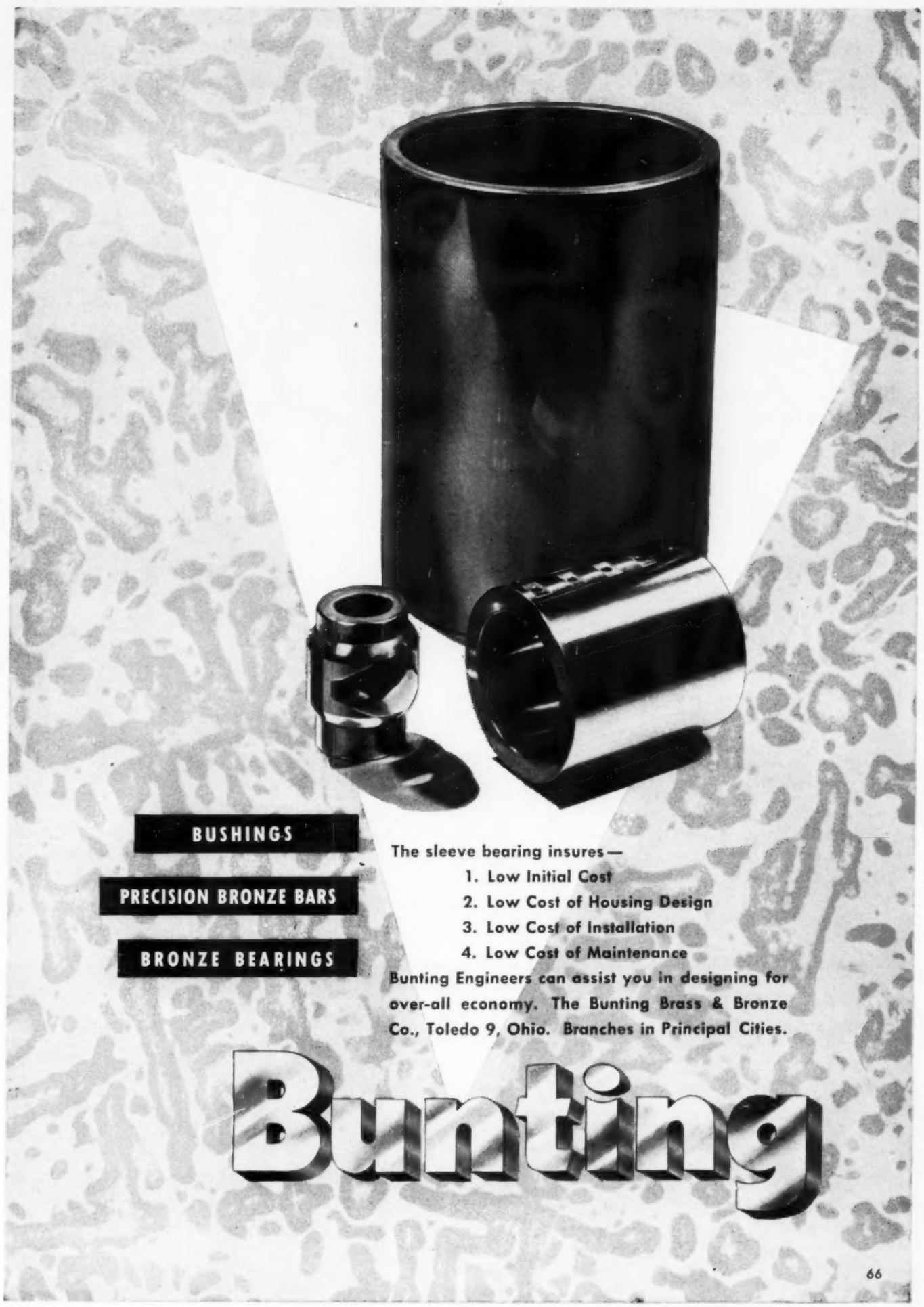
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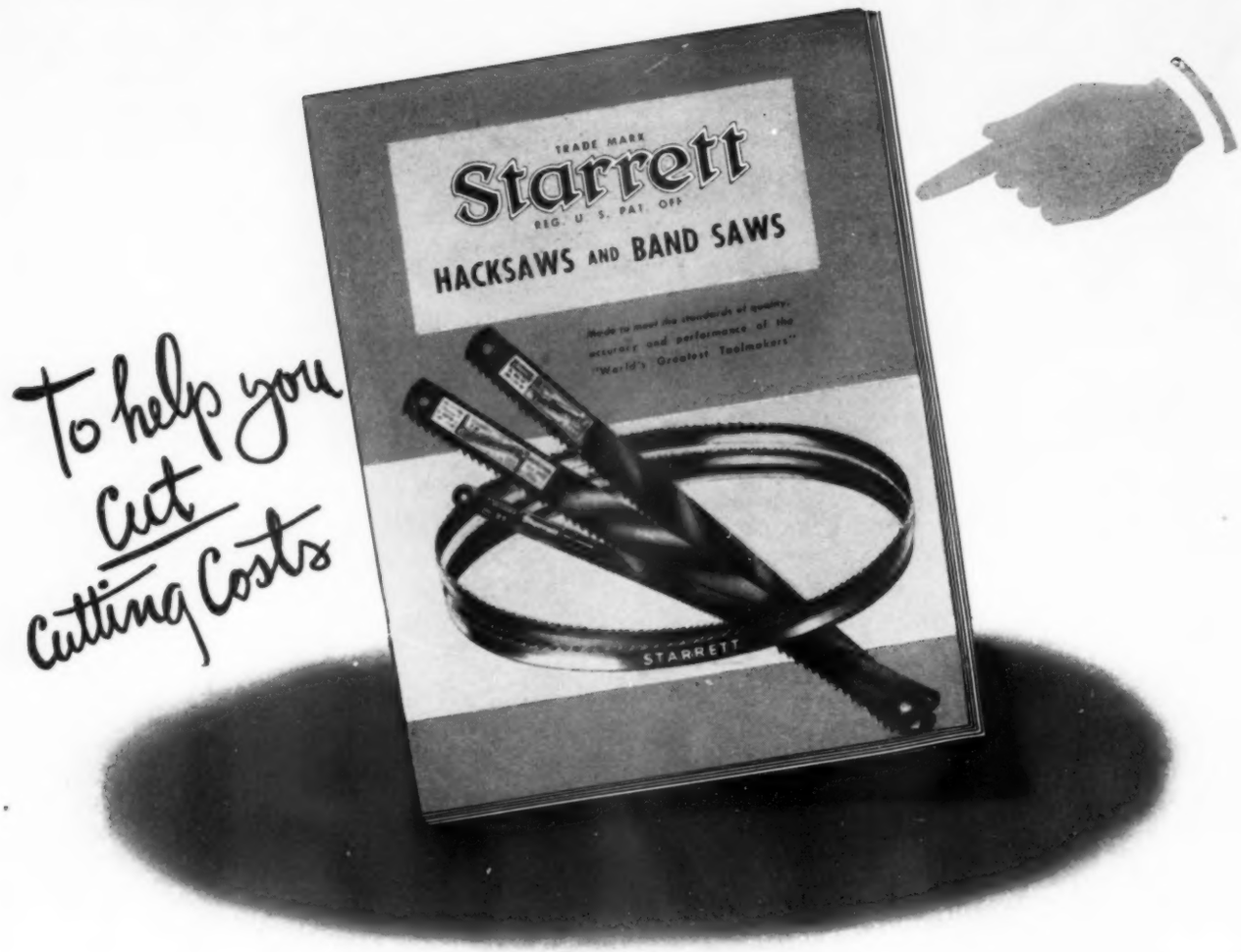

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Stock Allowance for Gear Finishing

BY CHAS. R. STAUB, Chief Engineer
MICHIGAN TOOL COMPANY

ENOUGH stock must be left on hobbed or shaped gears to be sure that any errors produced in cutting will clean up properly in the gear-finishing process. The accompanying chart enables the user to select a stock allowance that is suitable for gears to be shaved at a crossed-axis angle of 10° to 15°. An average range will be secured, which can be held easily with Class B hobs in most cases. For gears shaved with smaller crossed-axis angles, proportionately smaller amounts of stock should be left for shaving.

Example: assume a 7-pitch gear with 20 teeth, 14½° pressure angle. From handbooks, the constant for measurement over standard 0.2500 in. pins for that pitch of gear is 22.493. And the final measurement of the shaved gear over pins should be 22.493/7=3.213 in.

For a 7-D.P. gear, it will be seen from the chart that a stock allowance of 0.008 in. over two pins is well centered in the shaded area bounded by the "low" and "high" limit curves. Therefore, it will be feasible to use the 0.008-in. value, and to add it to the measured final diameter of 3.213 in., giving 3.221 in. as the inspection dimension for the preshaved gear.

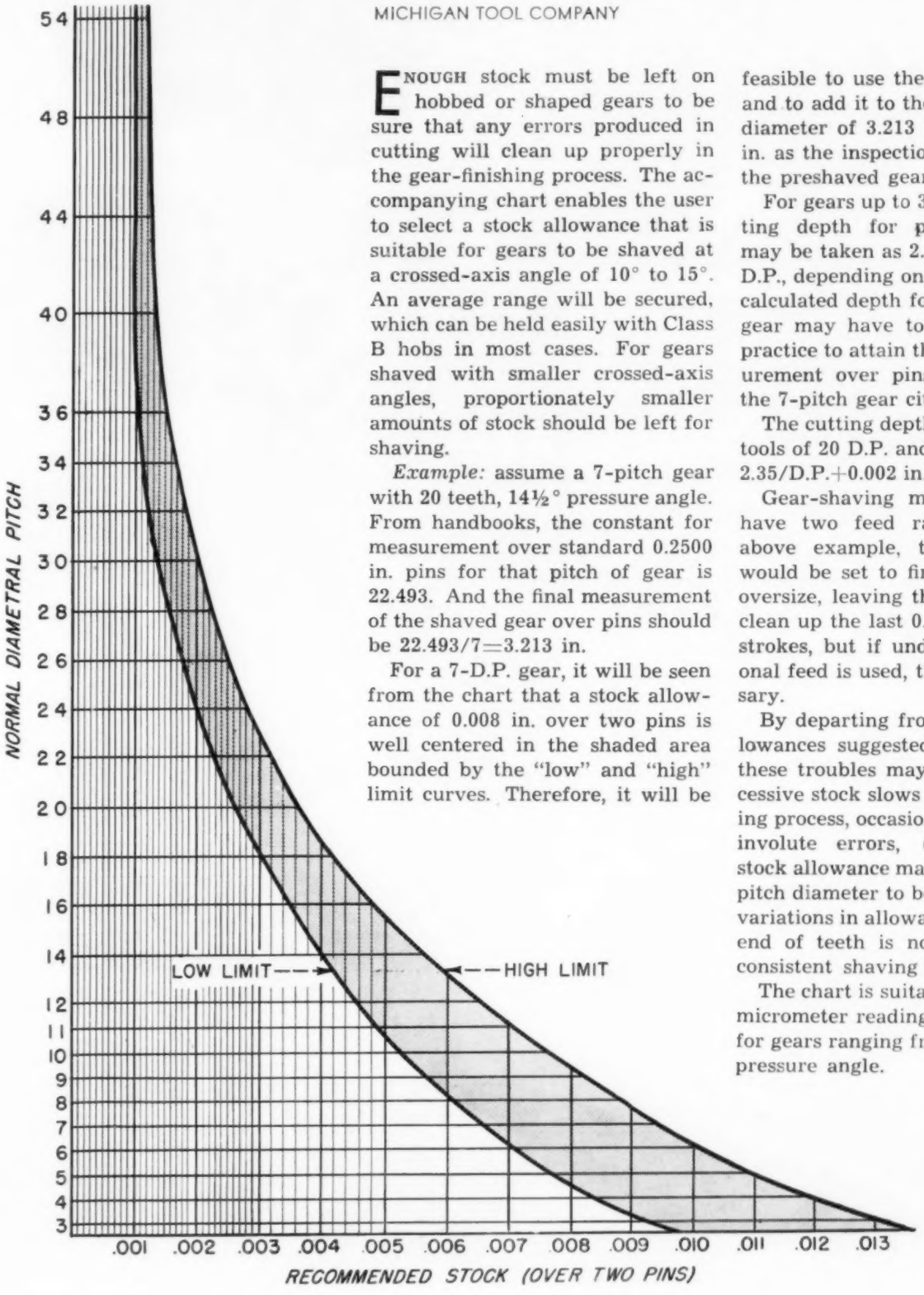
For gears up to 30 pitch, the cutting depth for preshaving tools may be taken as 2.35/D.P. or 2.40/D.P., depending on conditions. The calculated depth for the preshaved gear may have to be modified in practice to attain the desired measurement over pins (3.221 in. for the 7-pitch gear cited).

The cutting depth for preshaving tools of 20 D.P. and finer should be 2.35/D.P.+0.002 in.

Gear-shaving machines usually have two feed ranges. For the above example, the initial feed would be set to finish to 0.002 in. oversize, leaving the finish feed to clean up the last 0.002 in. in a few strokes, but if underpass or diagonal feed is used, this is not necessary.

By departing from the stock allowances suggested by this chart, these troubles may arise: (1) excessive stock slows the gear-finishing process, occasionally introduces involute errors, (2) inadequate stock allowance may cause the final pitch diameter to be undersize, (3) variations in allowance from end to end of teeth is not desirable for consistent shaving results.

The chart is suitable for use with micrometer readings over two pins for gears ranging from 14½° to 24° pressure angle.



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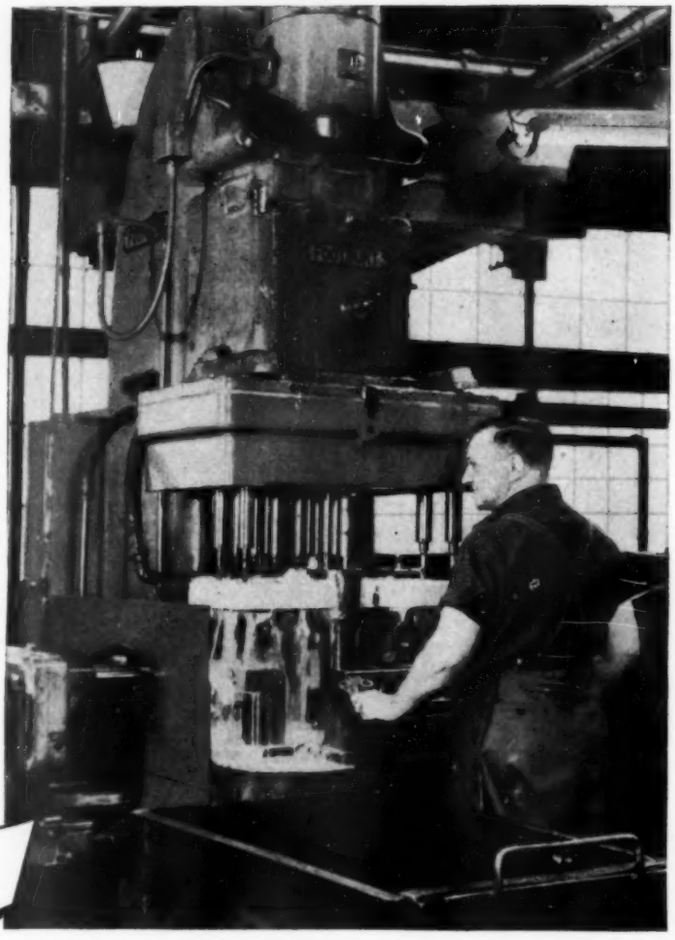


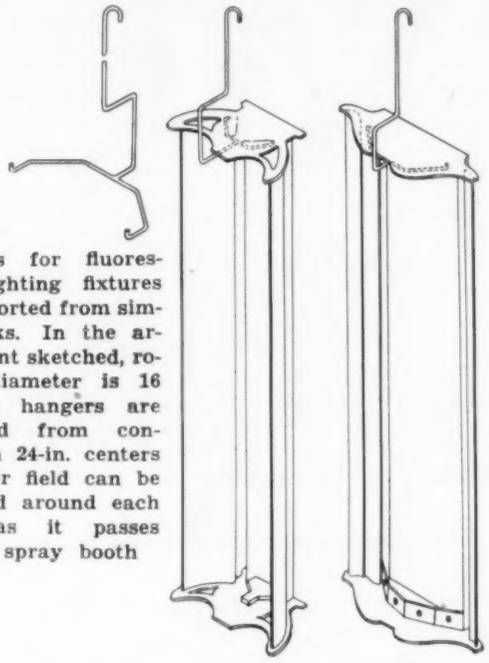
10-A Multiple spindle way type machine with indexing table used for several operations from two directions

FOOTBURT MACHINE TOOLS *Engineered* FOR PRODUCTION

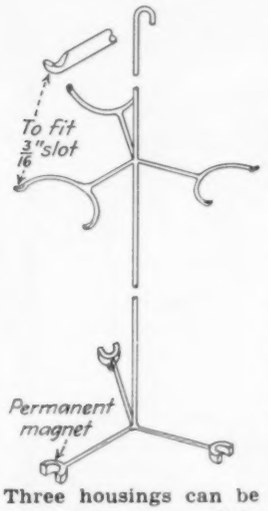
Hangers for Electrostatic Painting--III

Installments I and II were published previously, **AM**, Aug. 12, 1948, pp. 151 and 153.

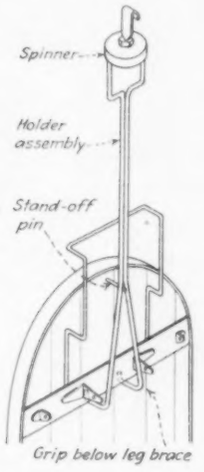
BY DR. EMERY P. MILLER RANSBURG ELECTRO-COATING CORPORATION



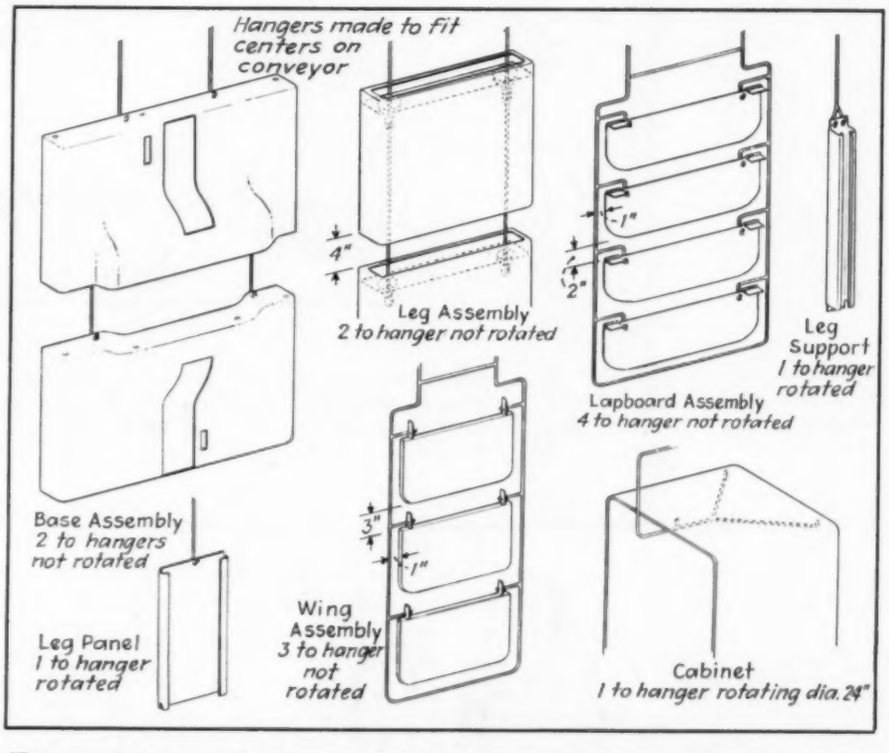
Housings for fluorescent - lighting fixtures are supported from simple hooks. In the arrangement sketched, rotating diameter is 16 in., and hangers are supported from conveyor on 24-in. centers so proper field can be developed around each part as it passes through spray booth



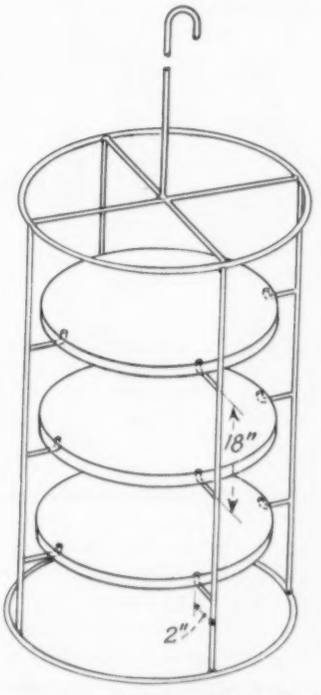
Three housings can be supported from this hook and magnet type. It has a rotating diameter of 15 in. and is spaced 24 in. between centers. Magnets prevent workpiece swaying



This specially shaped hanger holds metal ironing board vertically for spray coating top and bottom surfaces. Stand - off pin keeps workpiece vertical



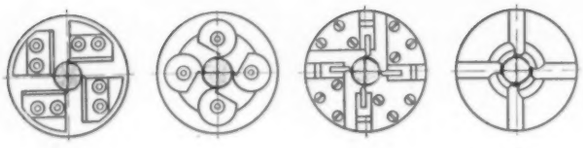
Hangers for supporting ironer parts during spray coating. Hangers for leg panels, leg supports and cabinet are designed for rotation. Each of these hangers is supported from two adjacent carriers on overhead conveyor. The one at the left is a simple combination of several "S" hanger hooks



Sometimes flat cylindrical parts can be spray painted satisfactorily when carried horizontally through the spray. This rack holds water heater tops

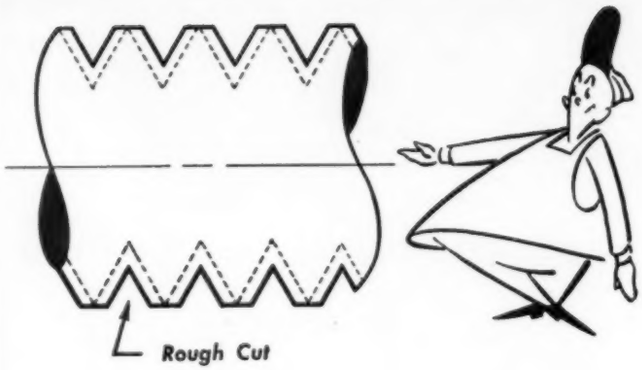
Hints for finish threading . . .

. . . by Stainless Sam

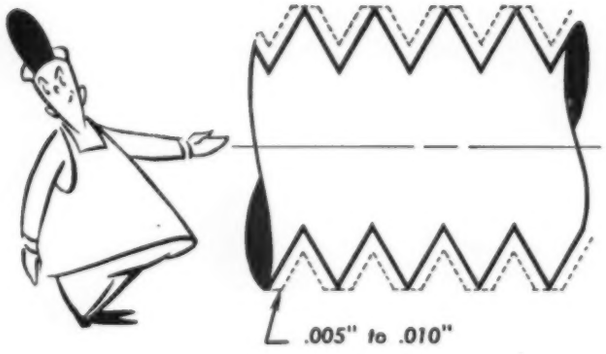


A Tangent — B Circular — C Inserted or Milled — D Hobbed or Tapped

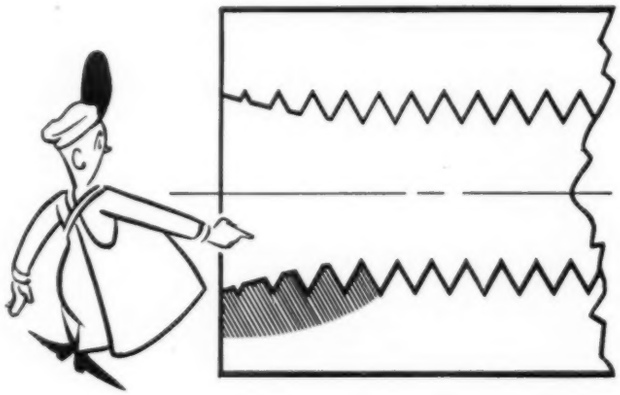
1 For threading of Stainless Steels there are four principal types of self-opening die heads: Tangent, Circular, Inserted Milled and Hobbed or Tapped. Use hobbed type chasers on free-machining grades. On the regular grades, milled-type chasers usually produce better threads.



2 Rough threading is always recommended for threading operations requiring good finish and close tolerance work, such as Class III fit. It should be remembered that in the rough threading stage, any variation in size will be reflected in the finished thread size.



3 Slow spindle speeds (5 to 10 SFM) should be employed. About .005" to .010" should be removed in the final operation with lapped finish ground chasers. A lead screw type machine is best for accuracy.



4 Hook grinds on chasers can be used to advantage when threading the chromium-nickel grades such as ARMCO 18-8. The hook should be ground to include the first full tooth of each chaser.

For complete information on threading and other machining operations, write for a copy of the new Armco booklet, "Machining of Armco Stainless Steels."

If you are not using ARMCO Stainless Steels, perhaps parts of your equipment or products could benefit by these rustless metals—often at no increase in cost. ARMCO Stainless resists heat and corrosion, adds strength and beauty to the products you make.

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STAINLESS STEELS

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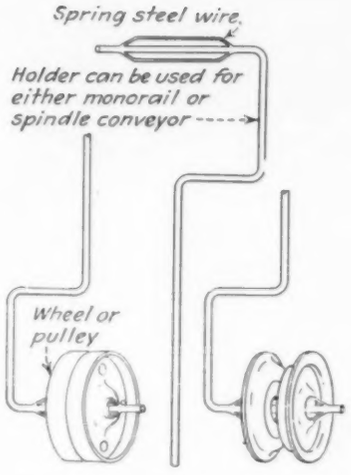
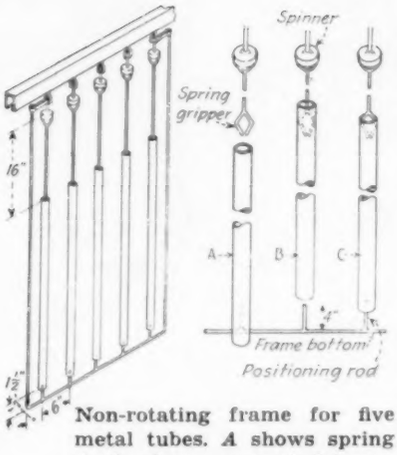
REFERENCE BOOK SHEET

Hangers for Electrostatic Painting--IV

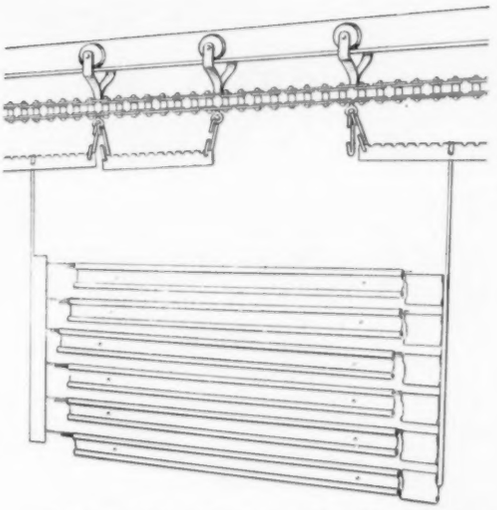


Carriers for spray coating wheels, pulleys or washers

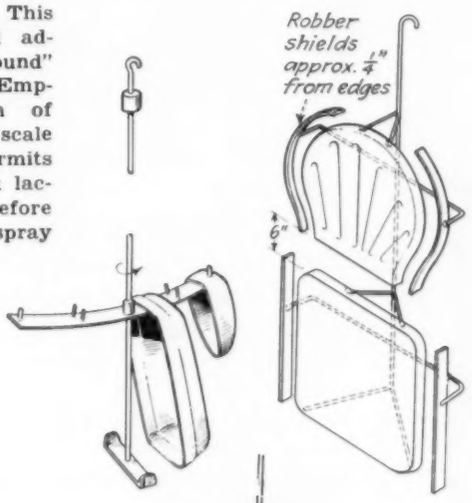
Bathroom scale housings are hung so dial cover shields the dial opening in main housing. In addition, two housings on same hanger shield each other's interior surfaces. This arrangement takes full advantage of "wrap-around" characteristic of system. Empty bar across bottom of hanger carries base of scale through cleaning and permits it to be dipped in black lacquer and removed before housings go through spray booth



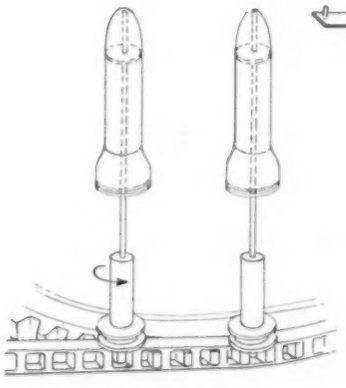
Non-rotating frame for five metal tubes. *A* shows spring steel gripper connected to rotator supported from conveyor chain hanger. At *B* top end of tube is pushed over gripper to clear the 4-in. high rod in frame bottom. At *C* tube is lowered over positioning rod to prevent sway as tubes are rotated within frame



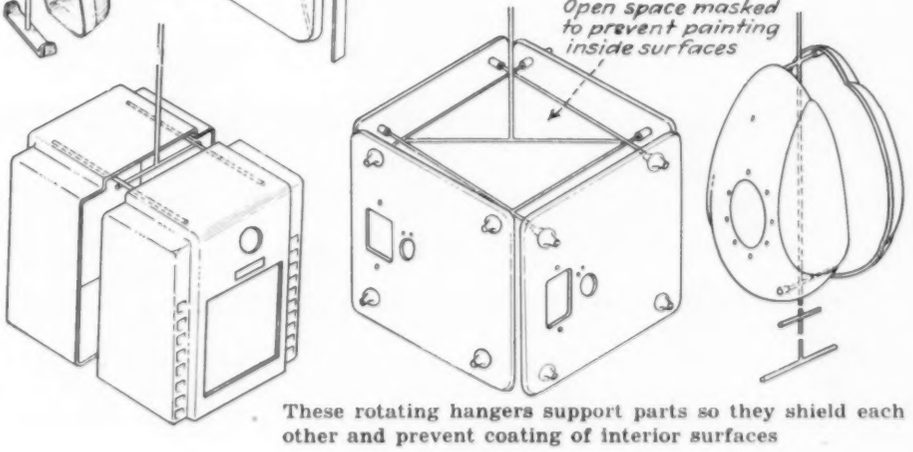
Long parts such as venetian-blind bottom rails are carried through electrostatic spray booth without rotation. Work holders are designed so channels are as nearly horizontal as possible. This brings workpieces parallel with flow of material from spray guns to take advantage of whatever carrying force exists when part enters charged field. In this application, spring clamps fit into ends of workpieces



"Field reduction shields" shaped to suit contours of work edges sometimes are used when flat parts are to be spray coated electrostatically. Build-up of paint is thus avoided on wide-flanged edges which cannot be spaced close enough together for self-shielding



Flashlight cases, finish spray-painted at 84 per min., are held on a vertical spindle with cross pin to keep them from wobbling. Carriers rotate by contact with a friction bar in the booth



These rotating hangers support parts so they shield each other and prevent coating of interior surfaces

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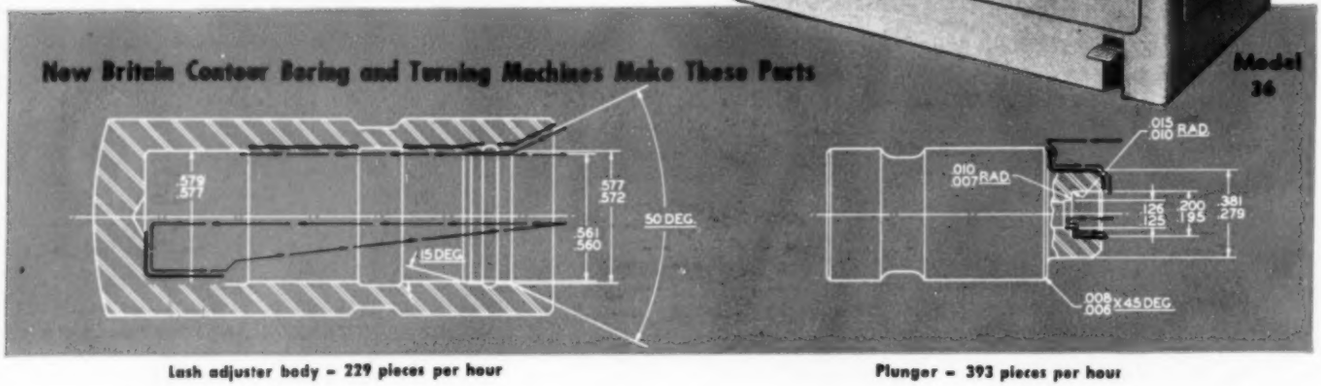
Manufacturer

- Saves Machines
- Saves Tools
- Saves Time



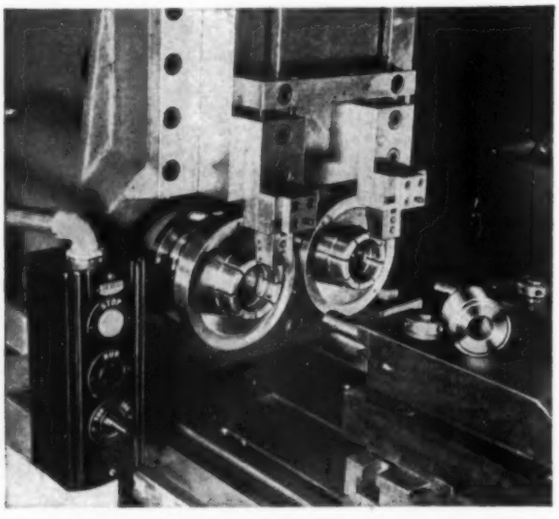
Lash adjuster body – 229 pieces per hour

Plunger – 393 pieces per hour

Generating contours instead of plunge cutting enables this manufacturer of automotive parts to handle multiple operations with more dependable accuracy, better finish and greater production. New Britain Contour Boring and Turning Machines kept down the original investment and the operating cost per piece in the manufacture of the valve assembly parts schematically illustrated above.

Each part is machined on a New Britain Model 36 equipped with contour slide. In both instances two single point tools are used. Twelve operations are performed on the steel plunger. The first tool machines the specified surfaces of the O. D. and faces the end. The second tool is then indexed into position and performs the critical boring operations.

Boring the cast iron lash adjustor body is completed in two stages. The first tool, accurately following its cams, bores two different angles and two diameters. The second tool, indexed into position by the contour slide, is jumped to the bottom of the bore to complete the three remaining operations.



SET-UP FOR MACHINING REVERSE PLANET PINIONS
Vertical slides present two facing tools to the piece while the boring tool is in operation. On many jobs such an arrangement can reduce cycle time as much as 50%.
948HE1

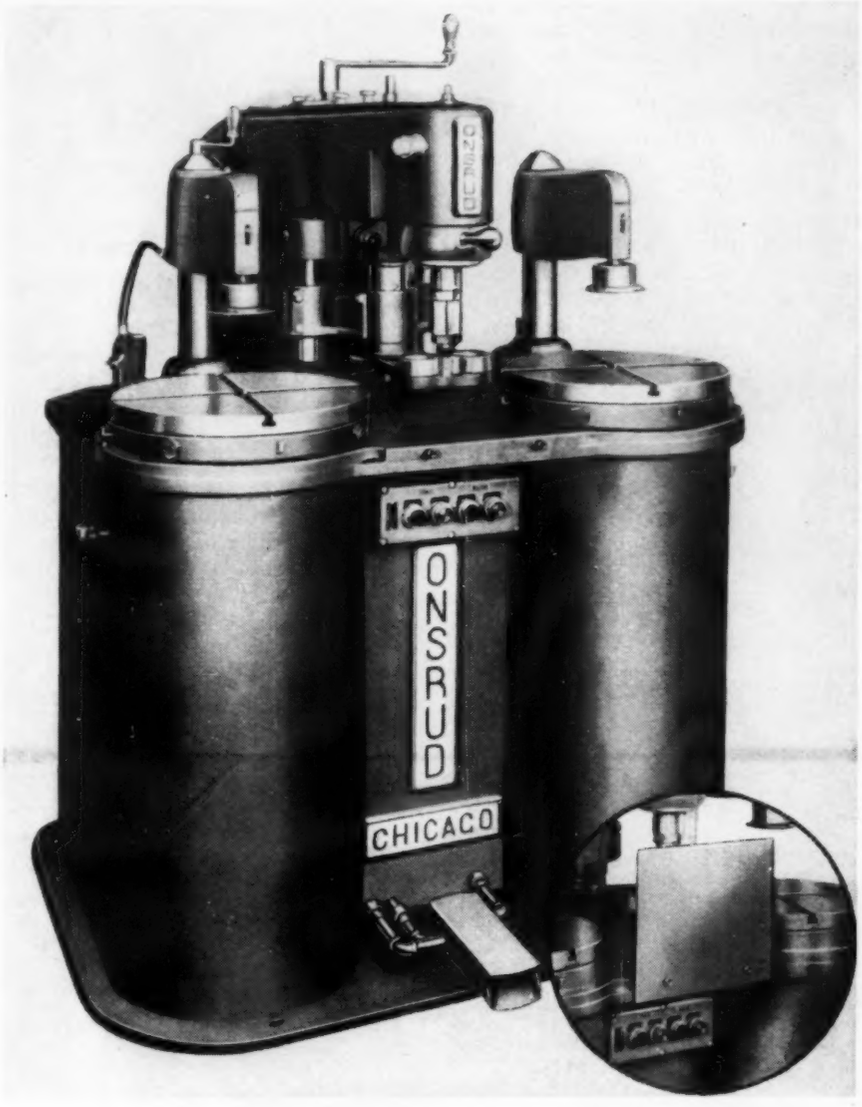
The trend to the *automatic* way of cutting metals is making itself felt throughout the industry in increased production and higher profits. You too can broaden your profit margins by turning expensive boring and turning operations into profitable productivity.

NEW BRITAIN AUTOMATICS COST LESS PER FINISHED PIECE!

THE NEW BRITAIN MACHINE CO. NB NEW BRITAIN *Automatics*

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

Shop Equipment News



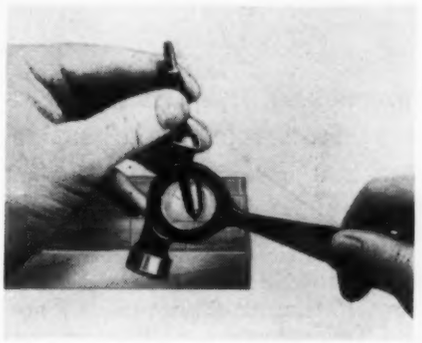
Onsrud Contour-Milling Machine Features 2 Tables, Works Aluminum

Mass production of round, rectangular, or irregularly contoured parts up to 18-in. over-all diameter is a continuous production operation with no interruption for set-up on the new Onsrud A-18 rotary-table, contour milling machine, developed by Onsrud Machine Works, Inc., 3921 Palmer Street, Chicago 47, Ill. The machine is designed for aluminum and all other non-ferrous metals with similar cutting characteristics.

Key to the machine's uninterrupted production cycle is the dual-table construction, which permits one of the tables to be located by the operator while work is being milled on the other table. Thus a second work piece is loaded and ready for completion of the first part with no time lost between machining cycles. As each milling operation is completed, the operator presses a pedal which automatically disengages the driving clutch for the rotating table, engages the clutch for the waiting table, shifts the cutting tool to the new work, thus starting a new cycle.

Work is rotated on the tables past the cutter. The cutter-head assembly consists of high-speed belt-driven spindle, cutter and guide roller, all mounted on the front end of a rugged overarm that pivots toward the right- or left-hand table as required. The roller contacts the pattern under the work and guides the cutter; the guide roller is held to the pattern by pneumatic pressure. Work clamps are designed to synchronize with the right to left travel of the overarm. The rollers are so designed that they can be adjusted in relation to the cutter to make up for wear. A snubber absorbs the shock when the roller contacts the pattern. The cutter spindle operates at a speed of 11,500 rpm. Table rotation speeds are variable while the machine is in operation and provide a wide range of speeds.

Work and operator are safeguarded by an air-line pressure switch which is set to stop the machine motors should air pressure for work clamps or tool arm fall below 60 psi. The lever controlling table speed is protected by a safety lock to guard against accidental bumping.

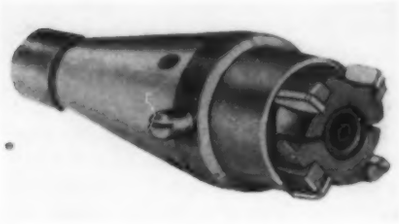


Ball Peen Hammer Combined With Glass in Starrett Tool

Accurate spotting and punching of center lines and intersections is simplified by a tool and diemakers' hammer introduced by The L. S. Starrett Co., Athol, Mass. A 7-power lens

built into the head of the hammer eliminates the usual fumbling when separate glass and hammer are used.

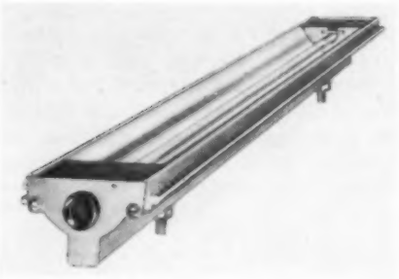
The hammer is a steel forging with flat- and ball-peen heads and weighs 4 oz. The heads are offset to permit use in corners or close to obstructions.



Howald Carbide End Mills Feature Replaceable Blades

The W. T. Howald Machine Works, 182 Sigourney St., Brooklyn 31, N. Y., announces carbide end mills with replaceable blades in 1½-in., 2-in., and 3-in. dia. sizes.

The mills have No. 40 NMTB, Weldon, or B&S No. 9 taper shanks. Blades are standard square stock without serrations, grooves, or other limiting elements. "Cone blade lock" permits rapid adjustment to close tolerances. This is claimed to reduce regrinding and setup time.



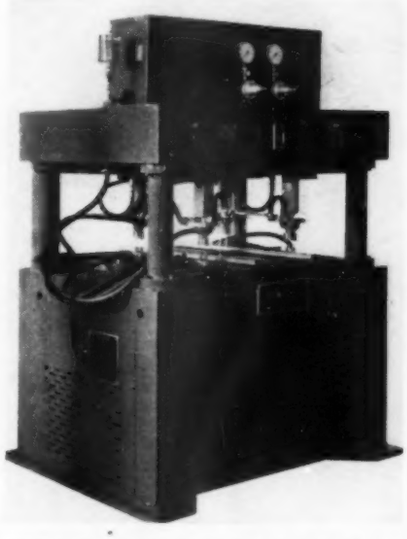
Infrared-Band Drying Heater Features Interlock-Grouping

High heat intensity and utilization of almost the entire infrared band are claimed for the Chromalox all-metal electric radiant heaters, announced by Edwin L. Wiegand Company, Pittsburgh. These heaters are for drying, baking, preheating and dehydrating where a longer-wave infrared heat source is desired and where rugged, all-metal construction is preferable.

The heating elements are mounted at the focus of a parabolic reflecting surface, which results in maximum heat radiation uniformly distributed over the surface to be heated. A negligible amount of visible light is produced from the Inconel-sheathed tubular electric heating unit which operates at temperatures of 1000 to 1400 F. Glassless construction permits an unobstructed, unfiltered path of infrared radiation of the longer wave lengths.

The interlocking and sliding bolt features permit maximum flexibility in fabricating groups of heaters into patterns—arcs, circles, squares, etc. Adjacent sections can be interlocked on a plane or, by means of hinge-acting joints, can be rotated up to 25°. Simple angle-iron frames can be formed to support the assemblies after the working pattern has been determined.

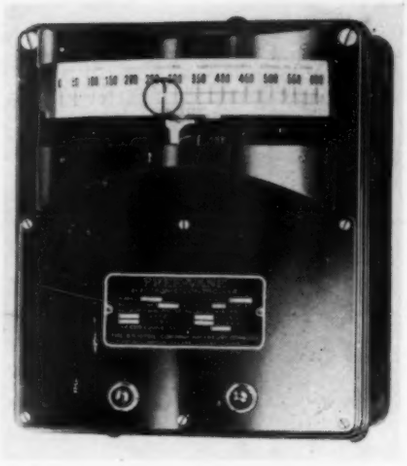
Three standard body lengths are 25, 31 and 47 in., with respective heated lengths of elements 17, 23 and 29 in.; standard height is only 4 in. Various wattages can be provided.



Multiple-Projection Sciaky Unit Welds Four Clips on Stove Panels

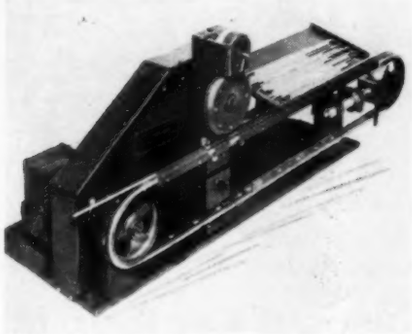
A special multiple-projection welder, built by Sciaky Bros. Inc., replaced an operation formerly accomplished by a spot welder, and was responsible for two advantages: production rate was increased from 80 to 360 units per hour, and the type of weld assured a perfect indentation-free surface on the exposed side of the panel.

This machine is rated 100 kva. at 50% duty cycle, and is guaranteed to perform the welding of 4 clips simultaneously on 4 sizes of stove panels. The electrode cylinders are hydraulically operated and adjustable to the 4 sizes of stove panels. Welder is complete with controls, and is claimed to produce 400 units in one 50-min. hour.



Bristol Model IE486 Pyrometer Controlled Proportions Current

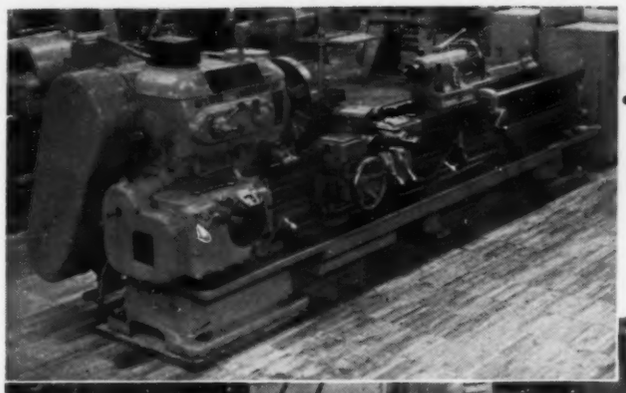
The development of a proportional-current input electronic pyrometer-controller has been announced by The Bristol Company, Waterbury 91, Conn. The new instrument, model IE 486, proportions the current input to electrically-heated furnaces, ovens, plastic molding machines, salt pots, and other similar equipment to provide practically straight-line temperature control. It does this by time-modulation of the input energy. The average energy supplied is proportional to the deviation of the temperature from the control point throughout a band width, which is adjustable from 0 to 2½% of full-scale reading.



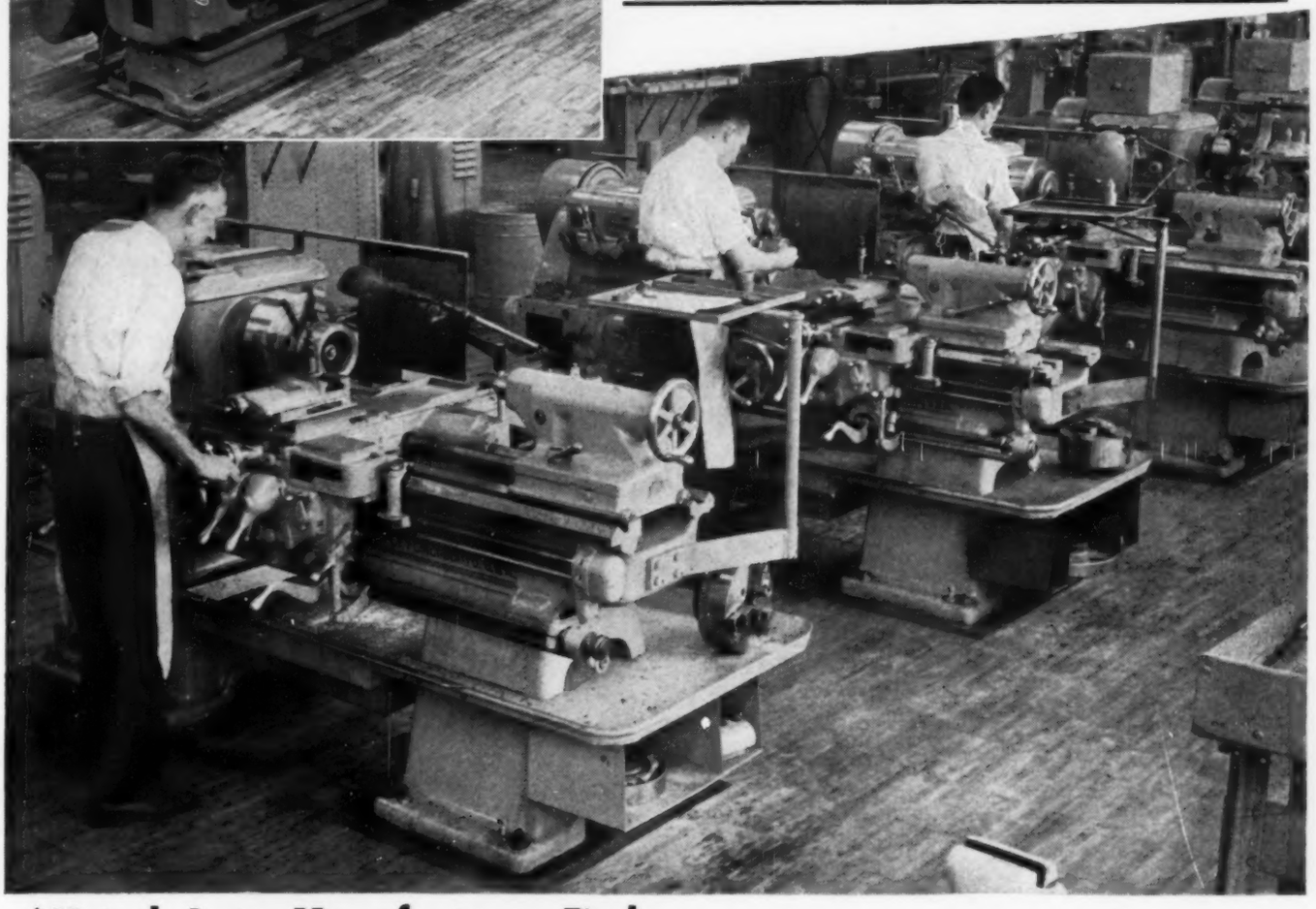
Automatic Pannier Machine Marks Rods and Tubing Up to 2-in. Dia.

A motor-driven working machine, made by the Pannier Corp., Pittsburgh, Pa., prints numbers or letters on rod, bars, and tubing from ⅛-in. to 2-in. dia.

The machine is powered by a ¼-hp. motor and includes hopper feed, quick-change printing wheel, belt conveyor, interior-feed ink supply and wear adjustments. Size is 44 by 14 by 18 in., and weight is 220 lb.



.....For experimental and new model tooling



*Noted Auto Manufacturer Finds

ACCURACY BETTER... TIME SAVED 10%... OUTPUT UP 15%

..with Lodge & Shipley Lathes

In the face of rising production costs, machine tools for new car models must be more versatile . . . must result in greater economies. It's significant that one of the nation's largest auto manufacturers finds Lodge & Shipley Lathes are "fine, general purpose lathes." Especially significant are the careful records kept by their production engineering department. These facts show that the new lathes are "sturdy, accurate and fast . . . increase output 15%, save 10% in time, improve accuracy."

In the photos, Lodge & Shipley Lathes are producing transmission brake drums, stator cams and dynamic balancers. Among other parts that are turned, bored, faced and threaded on these lathes are: flywheels, axle shafts, gear blanks, converters, camshaft blanks and balancer parts. High speed and carbide tipped tools are used to machine alloy steels, cast iron, aluminum, brass and other metals.

The experience of this auto manufacturer with Lodge & Shipley Lathes is typical of other auto manufacturers and metal working shops. A Lodge & Shipley Engineer will gladly show you other data . . . prove that one of the various Lodge & Shipley models can do your lathe work to more profitable advantage. Write for Condensed Catalog showing the complete line.

*Name on request.

THE Lodge & Shipley COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
SPECIAL PRODUCTS DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

Seven-Diamond Dressing Tool Trues Large Grinding Wheels

Diamonds & Tools, Inc., 19345 John R Street, Detroit 3, Michigan, announces an addition to their line of diamond dressing tools, the C-7X.

The C-7X dresser is claimed to do wheel dressing with 1/10 the cost of a single-point dresser and approximately 1/3 of the cost of an ordinary cluster tool.

This tool contains seven diamonds with a total diamond weight of between 1 1/3 and 1½ carats. The shank diameter is 7/16 in. and like all of D & T's tools the diamonds are set in Colmonoy metal. The C-7X is designed for dressing wheels on centerless grinders, large O.D. grinders and surface grinders.

Grand Rapids Point Thinner Tapers Down Worn Drill Webs

A new point thinner has been announced by the Gallmeyer & Livingston Company of Grand Rapids, Michigan.

According to tests reported by the manufacturer, this attachment for any of the new series T drill grinders will taper worn drill webs to the exact angle required for maximum drilling efficiency. In thinning the web, this machine maintains the dead center of the drill and automatically compensates for unequal flute depths so that the drill is certain to cut to the correct size. The action of the thinner is so controlled that the ground portion extends up the flute just far enough to provide the necessary taper and to insure the efficient operation of the drill.

Watch-Size Dial Indicator Measures Sheets, Wire, Rods

A vest-pocket indicator is announced by the L. S. Starrett Co., Athol, Mass., for checking paper, leather, sheet metal and wire.

The indicator fits in the curve of a thumb and index finger and features direct readings to thousandths. A small dial in the center indicates hundredths.

The spindle is raised to the maximum range of ⅜ in. by a sliding, serrated plate on top of the gage. Crystal is non-breakable and components are stainless steel and chrome-plated, die-cast steel.

Eutecrod 1805FC Coated Rod Joins Copper in Torch Jobs

Eutectic Welding Alloys Corp., New York, N. Y., is marketing Eutecrod 1805FC for piping, tank, roofing and heating apparatus applications.

The rod is a thin-flowing, low-melting-point (brazing type) alloy. Tensile strength is claimed at 90,000 psi., and Brinnel hardness is 160-180. It is available in ½-in., 3/16-in., 3/32-in. and ⅛-in. sizes, flux-coated, and 1/16-in. bare rod.

Pressure Washer Mixes Water And Air for Industrial Cleaning

D & M Products, Inc., 4655 Kingswell Ave., Los Angeles 27, Cal., has announced an improved air and water pressure washer. The gun-type device controls the mixture to penetrate and clean without harming the finish or back-splashing.

The proportions of air and water can be adjusted for a varied effect of the stream.

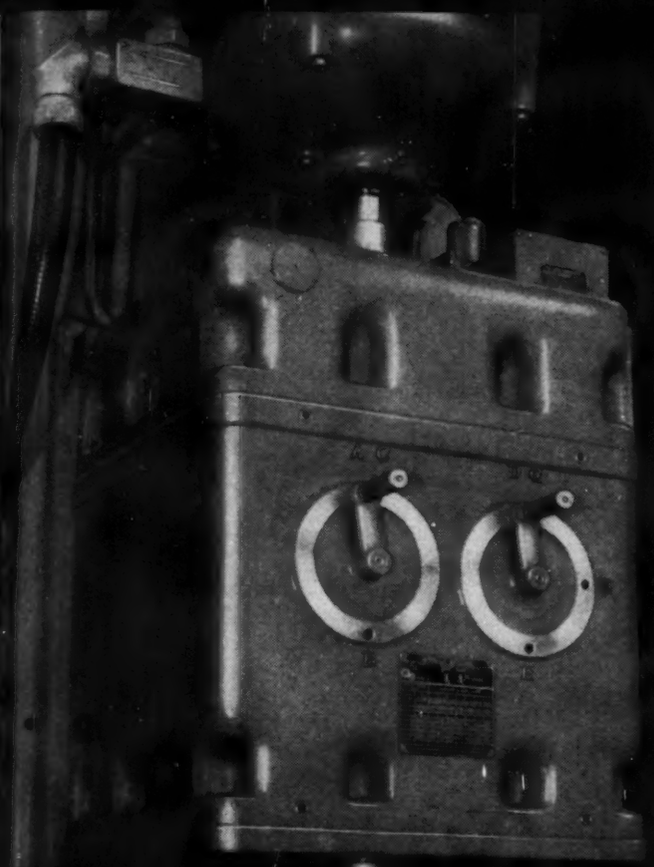
Tungweld-C and F Rods Deposit Hard-Surface Material in Joints

The Lincoln Electric Co., Cleveland, O., is now producing two new electrodes of the coated tubular type for depositing super-abrasion resisting surfaces of weld metal. The alloy is deposited into the molten crater where it is either bonded into a tough iron-alloy matrix or alloyed by the heat of the arc with the base metal to create the final hard-surface alloy.

Tungweld-C is a tubular, light coated electrode which contains in the tube coarse particles of tungsten carbide. The particles are deposited by the arc in the weld crater and as the weld solidifies are held in a tough iron-alloy matrix or alloyed mended for tool surfaces to resist extremely severe abrasion.

Tungweld-F is a shielded arc tubular electrode containing fine particles of tungsten carbide. It produces a smoother, thinner and sharper edge than the rough edge of Tungweld-C.

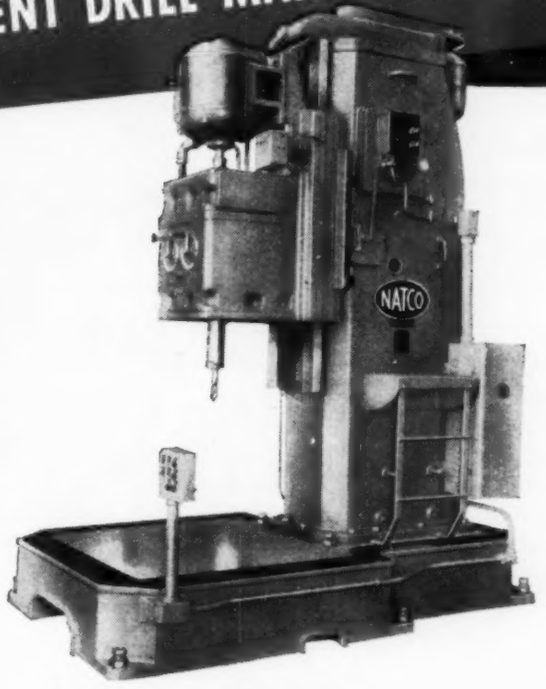
The electrodes are available in 14-in lengths in ¼-inch size, packed in 5-lb. containers.



NATCO Heavy Duty Hydraulic Drilling Machine with single spindle 7-speed geared head —

—FOR TESTING DRILL LIFE

FOR A PROMINENT DRILL MANUFACTURER



Proof of Adaptability of NATCO Engineering

To help a well known drill manufacturer test the durability of his product NATCO produced a machine that would operate at peak efficiency under all abnormal or overload conditions. The motor on this machine maintains a synchronous speed up to the rated H. P. when drills become dull. A shear pin is provided to prevent destruction of gears in the head in the event of serious overloading. A range of 42 different speeds is provided thru change gears. The machine is heavy duty to give maximum rigidity to the column, head and spindle. As the load builds up to a predetermined value a torque limiting device operates to stop the motor.

Whether you have a special drilling, boring, tapping or facing problem or just a routine production problem involving these operations you will find it profitable to call a NATCO Field Engineer to help you. Write, phone or wire today for details on NATCO Machines that may assist you in obtaining more economical production.

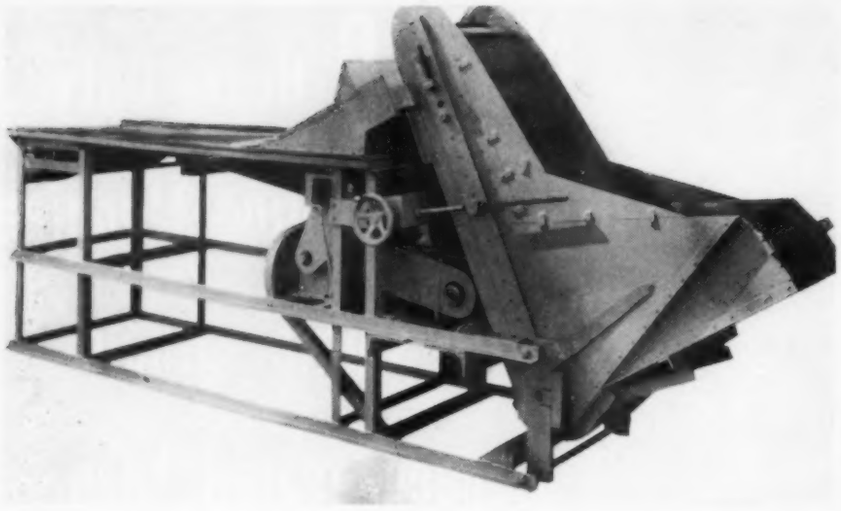
NATCO DRILLING, BORING, TAPPING AND FACING MACHINES

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Ind., U. S. A.

Branch Offices: 1809 Engineering Bldg., Chicago • 409 New Center Bldg., Detroit • 1807 Elmwood Ave., Buffalo • 2902 Commerce Bldg., New York City

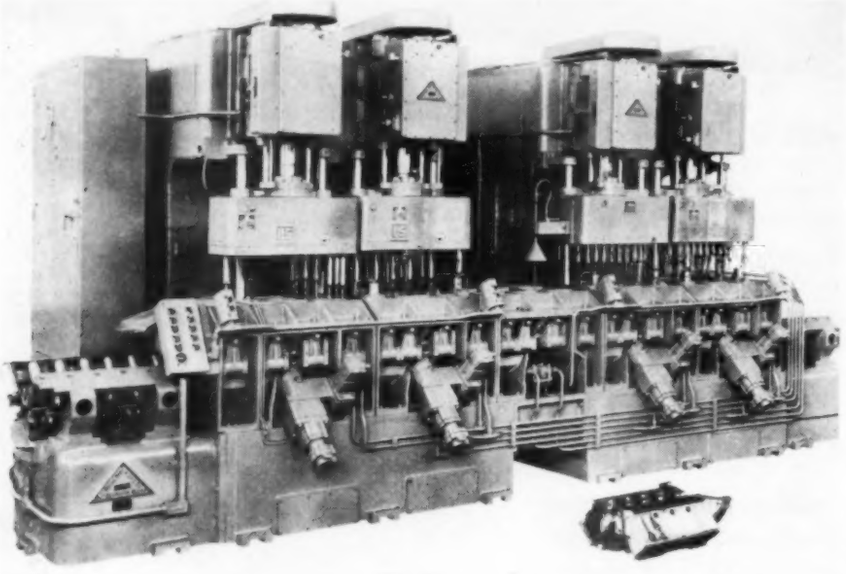
Call a Natco Field Engineer



Elevator-Hopper and Conveyor Belt Featured on Prutton Inspection Table

The D. H. Prutton Machinery & Tool Co. of Cleveland have made an addition of an inspection table to their line. An elevator-hopper feeds any small, mass-production item onto a 2x8 ft. conveyor belt for visual inspection. A multi-speed transmission and a variable-angle control allows any desired distribution on the table.

Because it is designed for small parts, such as nuts, bolts, washers, etc., it is possible to inspect as many as 130,000 pieces per hour. The inspection table requires 48 square feet of floor space and is built so that all moving parts are readily accessible.



LINE-PROCESS DRILLING MACHINE, developed by Le Maire Tool & Mfg. Co., Dearborn, Mich., works 72 V-8 cylinder blocks per hr. with drilling, reaming, counterboring, and chamfering operations. Loading and unloading mechanisms are supported on two end bases, and a bridge-type base carries the work fixtures through a central idle position. Hydraulic power operates the transferring, locating and clamping mechanisms. Decelleration at the idle position is made gentle by a valve in the hydraulic system. Piping is exposed for easy repair and adjustment. Chips are removed by chutes to the rear, and each unit has a push-button for individual setup. The seven-station machine is automatic

Hexacon Soldering-Iron Element Withstands Unusually High Heat

Hexacon Electric Company, 135 W. Clay Ave., Roselle Park, N. J., announces a new electric soldering iron for use on fast production lines where greater speed is required from an iron with a small tip diameter.

This iron is the plug-tip type, rated at 200 watts, 110 or 220 volts, ac. or dc., with a ½-in. dia. tip. Special provisions have been made in the element construction to withstand an unusually high operating temperature.

It is designated as Model P212, list price: $9.50; delivery immediately from stock. Replaceable elements and tips are available.

BW Whiteprinter Exposes and Develops 42-in. Rolls at 10 fpm.

The Charles Bruning Company, Chicago, Ill., announces their new model 21 BW Whiteprinter. Continuous in operation, the Model 21 exposes and develops cut sheets or roll stock up to 42-in. width—any length. Printing speed ranges from 6 in. to 4 ft. per minute depending on the transparency of the original. The machine can produce more than three thousand 8½ x 11 BW Whiteprints per day.

One of the features of the Model 21 is its built-in, constant-voltage transformer. The light source of exposure is a stationary 1,200 watt glass mercury-arc lamp, mounted within a cylinder having sufficient length to provide ample and uniform

225 Axle Shafts Drilled, Countersunk and Reamed Hourly

Among the first to realize that *"you can't meet tomorrow's competition with yesterday's machine tools"* are automobile executives.

Evidence of their desire for equipment which can increase output and shrink costs is presented by the new Cross special machine for drilling axle shafts. It materially steps up production—225 parts hourly *with only one unskilled operator.* (Even better performance is possible by making provision for handling three or four parts per station instead of two.)

Equally important, this new machine improves accuracy—concentricity between pilot diameter and bolt circle diameter is automatically assured.

PART: Automobile Rear Axle Shaft.

OPERATION: Drill, countersink and ream five holes in flange.

PRODUCTION: 225 pieces per hour.

EQUIPMENT: Cross Special Drilling Machine.

FEATURES: ☆ Four-station, power operated index table ☆ Independent loading station ☆ Station one, drilling; station two, countersinking; station three, reaming ☆ Two pieces handled in each station ☆ Independent floating work holding fixtures insure concentricity between holes and pilot diameter ☆ Flexibility for part design changes through use of standard Cross column and index table ☆ Hardened and ground steel ways ☆ Hydraulic feed and rapid traverse ☆ Push-button controlled automatic work cycle.

Investigate Cross Transfer-matics—the newest machine tool development for continuous automatic production.

THE CROSS COMPANY

Established 1898

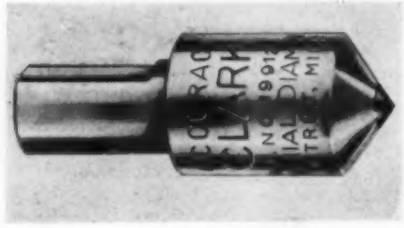
SPECIAL MACHINE TOOLS

MILLING • DRILLING • TAPPING • BORING • TURNING • SHAPING • GRINDING • HONING

DETROIT 7, MICHIGAN

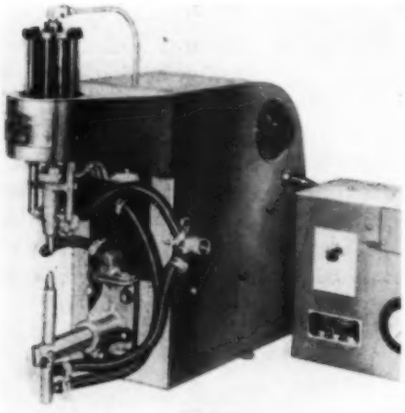
distribution of light over the entire exposure area. The transformer assures longer lamp life and enables the lamp to operate at its optimum rating, regardless of line voltage changes, within a 30-volt range.

The developing unit of the Model 21 employs grooved dual-application developer rolls, which, with the aid of a third roll, apply a minute film of BW developer solution to both sides of the BW medium simultaneously, thus assuring proper chemical balance of the developer solution and flat, positive copies of the original. Developing speed is 10 fpm.



Clark Diamond Penetrators Are Added to Hardness Penetrators

Two improved diamond penetrators for Rockwell testing are announced by Clark Instrument, Inc. The "C" diamond penetrator fits all makes of hardness testers for standard Rockwell testing, and the "S" diamond penetrator fits all machines for superficial Rockwell testing. Diamond points are specially selected for proper stratification and freedom from internal stresses. The penetrators are made to proper size and shape, and are lapped. The penetrators are furnished as a standard accessory on all Clark testers.

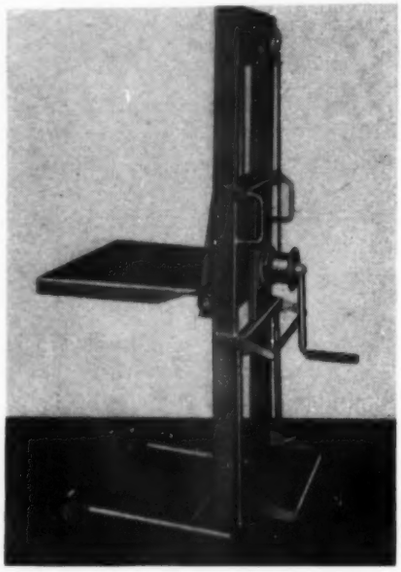


Small Parts Welded by 7½-kva. Automatic Weldex Bench Unit

For joining small metal parts, Weldex, Inc., Detroit, Michigan, has introduced a fully automatic 7½-kva. bench-type spotwelder claimed to be a time and money saver. The welder (Model 752-PB) handles light nonferrous metals of the same or dissimilar alloy and thickness on a high-speed production basis and ferrous metals up to two thicknesses of 14-gage cold-rolled steel.

In addition to air strainer, regulator, gage and lubricator standard equipment includes: a built-in four-step transformer-tap-changing switch; single-acting air cylinder; magnetic long-life contactor; and electronic timer. It is regularly furnished for 220-volt, 60-cycle, single-phase ac. operation, 380 or 440 volts on special order.

Standard throat depth is 4½ in.



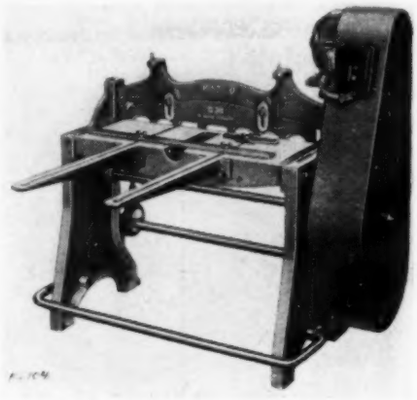
Handy Hoister, Hand-Operated By Winch, Has ¼-Ton Capacity

Lewis-Shepard Products Inc., Watertown, Mass., has produced a new CH Handy Hoister, a light-weight, rugged stacker.

Crank-up-crank-down operation through planetary gear-drive winch permits placing and holding platform at any level. One revolution of the winch handle gives full 3-in. lift.

Wheels, casters, and sheave turn on roller bearings. The platform of heavy-gage reinforced sheet-steel rolls on guide wheels equipped with ball bearings and safety guards. Base, of open-end type, straddles machines or other obstacles. Arc-welded, tubular base members are used to resist twisting of frame work.

The CH Handy Hoister is available in a standard size of 500-lb. capacity, having 24 in. x 24 in. lifting platform; 5½-in. lowered height; 58-in. lifting height; 71-in. over-all height and 5-in.-dia. wheels at front and rear, either steel, rubber, or molded plastic tires.



Framco Produces Power Shears In 36-, 42-, and 52-in. Sizes

Framco Machine Co., Racine, Wis., introduces a new line of power squaring shears. The low-cost, light-weight models will handle 18-gage stock and weigh, with motor, 1050, 1200 and 1400 lb. respectively.

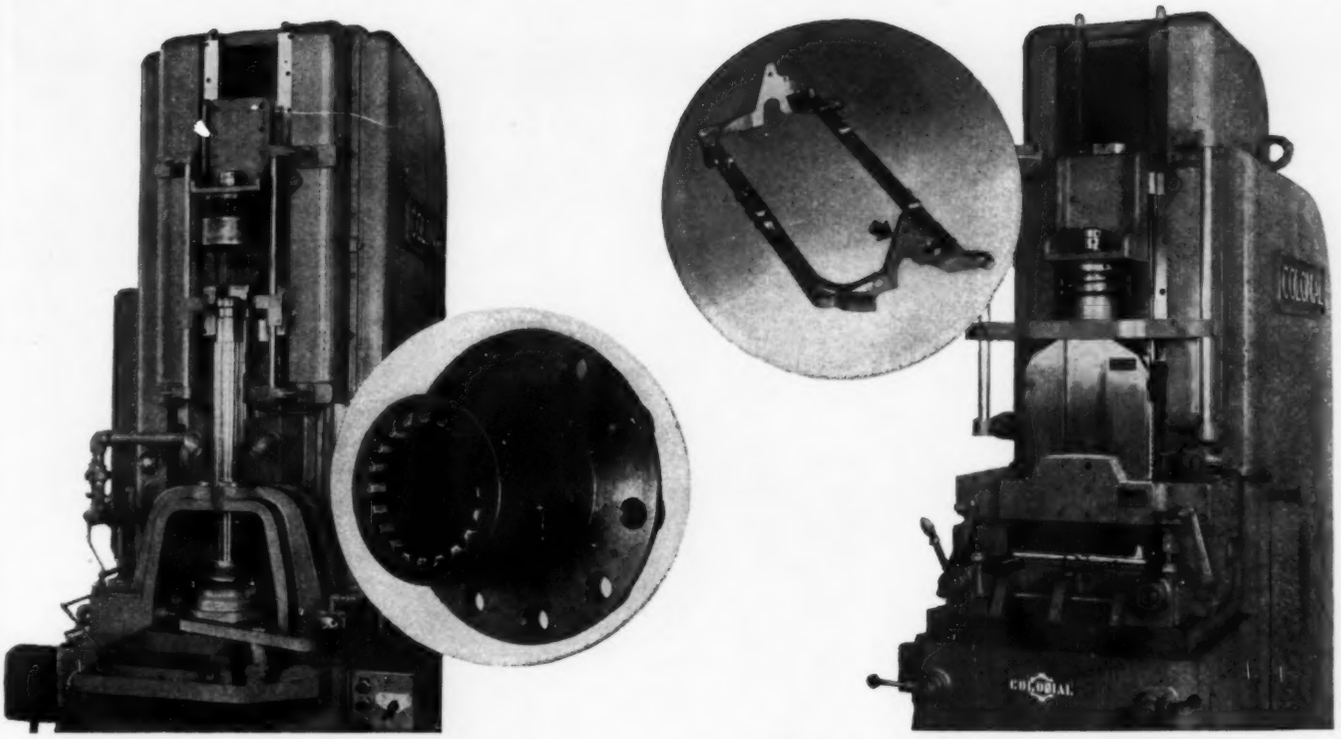
High-carbon tool-steel blades are included, and front and back gages, guard and hold-downs are adjustable. The shears have a single-stroke mechanism that can be set for continuous operation.

J & L Carbide-Tipped Thread Chasers Provide High Finish

Jones & Lamson Machine Company, Springfield, Vermont, announces carbide-tipped die chasers with ground thread forms. A high quality finish with a class III tolerance can be obtained.

Besides increasing threading speeds, the lengthy tool life of these chasers furnishes economy when they are suitably applied and correctly handled. They are effective on steel, hard rubber, fiber and abrasive materials which have a rapid dulling action on ordinary chasers.

Carbide chasers can only be used successfully on machines with sufficient power, speed and rigidity to



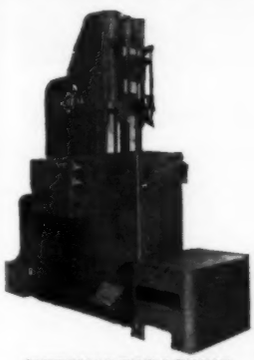
HEAVY STEEL WHEEL HUBS ---or--- LIGHT WEIGHT TYPEWRITERS

They're all the same to versatile high speed Colonial Broaching Machines

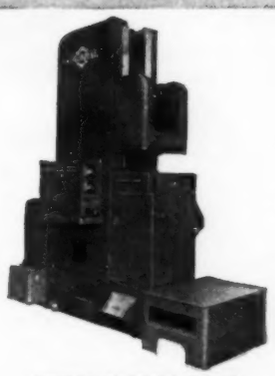
PIONEERS OF H.S.S. BROACHING
COLONIAL
BROACH CO. DETROIT 13
BEST BY TEST

Shown here are two Colonial Pull-down broaching machines. They're fundamentally alike, but one has the job of broaching 8-pitch splines in a forged steel wheel hub, while the other broaches the inside faces of lightweight aluminum typewriter carriage frames. Automatic broach handling, complete guiding of broaches above and below the part, and high accuracy are characteristic of both of these standard Colonial machines. Of course there is a difference in machine capacities. One is a six, the other a 15 tonner. We'll be glad to tell you whether production cost of your parts can be cut and output rate increased on one of these or other types of the latest Colonials.

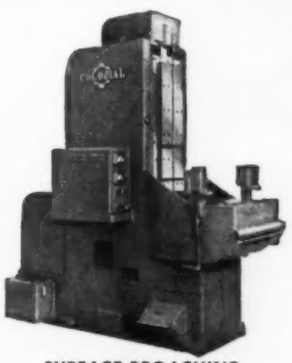
Have you seen these new Colonials? Ask for Bulletins describing them!



INTERNAL BROACHING
PULL-DOWN
BULLETIN NO. RD-48



INTERNAL BROACHING
PULL-UP
BULLETIN NO. RU-48

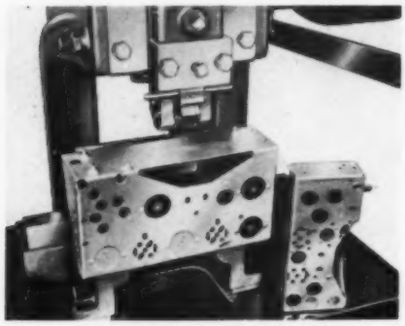


SURFACE BROACHING
SINGLE-RAM
BULLETIN NO. RS-48

ALSO:

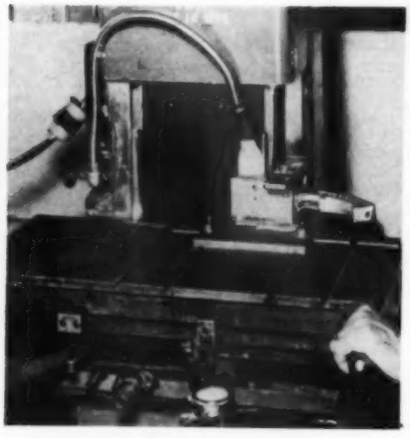
Colonial Dual-Ram surface broaching machines, Broaching Presses and Universal Horizontal Broaching Machines.

handle them effectively. Because of these and other rigid requirements, selection of suitable jobs should be determined by engineering analysis.



Double Serial-Number Stamping Performed by Acromark Fixture

A new adjustable stamping fixture adaptable for use in any standard press is announced by The Acromark Company, Elizabeth, N. J. The fixture is a casting on which is mounted adjustable steel slide blocks that permit the stamped part to be numbered on the end and again on the side in two successive press strokes. To accomplish duplicate numbering, a duplicating fixture for operating the actuating arm of the numbering head is added. Adjustment of the stamping fixture is readily made by the loosening of the screws and the fixture as illustrated will hold stamped parts having one or more flat surfaces ranging from 1 in. x 2 in. to 4 in. x 10 in.

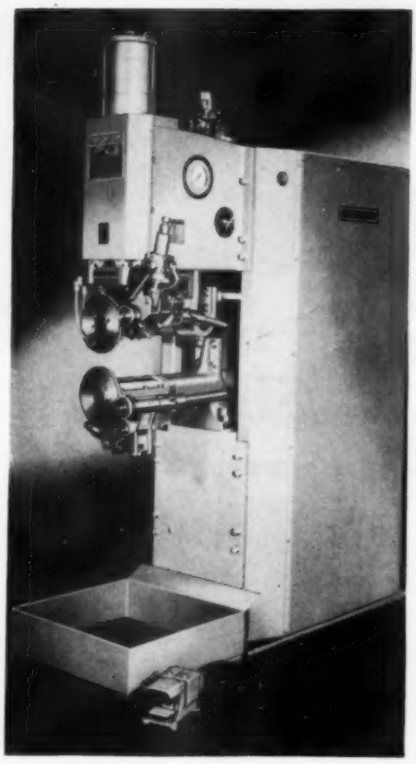


Porter-Cable Adds Precision Table to BG-8 Belt Grinder

Porter-Cable Machine Co., Syracuse, N. Y., announces an improved automatic feed table for its BG-8 wet-abrasive belt grinder. The table improves the accuracy and smoothness of feeding the work into the belt.

Two separate fluid systems have been installed—one for coolants, and one for hydraulic oil. A rod has been added to the former free piston, with a gland at the end of the cylinder oil shield, to assure smooth, positive action.

T-slots on the table hold fixtures, and a micrometer stop halts the operation. It can be reset immediately. The table automatically controls pressure and rate of feed, and a dial indicator shows the rate of machining.



Progressive Seam-Welding Line Includes 3 Universal Models

A complete new line of roller-head seam welders has been announced by Progressive Welder Company, 3050 E. Outer Drive, Detroit 12. The line comprises light-, medium- and heavy-duty sizes. Each is available for circular welding, for longitudinal welding, or for both ("universal" models).

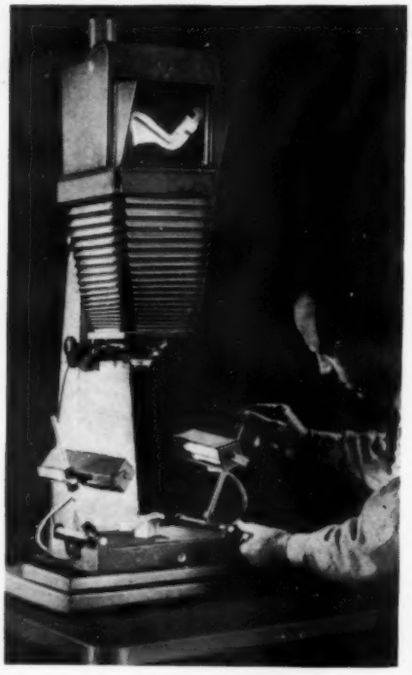
A head completely guided and aligned by four sets of anti-friction rollers insures that the welding wheels will follow up and down small deviations in material thickness and contour. The rollers are matched in pairs and guide the head the full length of its vertical travel, riding on positive-alignment V-guides on hardened and ground ways.

This construction has been made successful by the frame design of the new machines. Instead of having a fairly uniform cross-section, the front of the machine column is extremely rigid and well braced, while the rear of the column is of fairly light construction designed to provide maximum accessibility to all components inside of the machines.

A new wheel-shaft-bearing design is said to provide much more even current transfer than feasible before. The motor drive unit for the wheels is removable as a complete unit for servicing if required.

A safety feature is that drive shafts are non-magnetic and completely insulated. An adjustable-retractable stroke is provided on these machines to insure minimum floor-to-floor time in seam welding of parts.

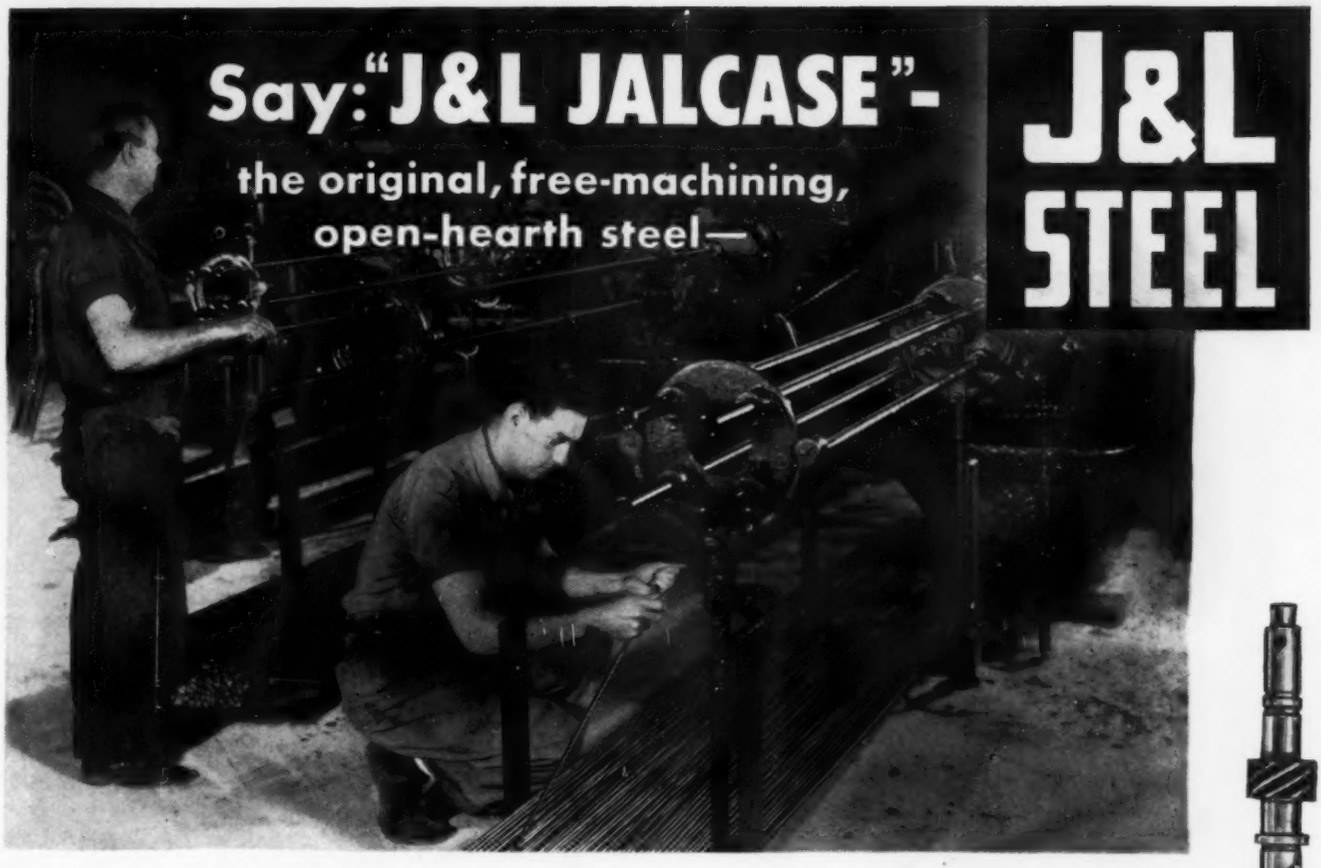
The seam welders may be used either for continuous, water or gas tight seam welding, or for roll-spot welding and may be used for cold-rolled steel, stainless or other alloy steels, aluminum and other nonferrous alloys as well as various types of coated metals.



Bausch & Lomb Model L Handles Visual and Photographic Work

A medium-size universal photomicrographic camera and accessories have been announced by Bausch & Lomb Optical Co., Rochester, N. Y., designated as Model L.

The equipment produces a 5- by 7-in. negative with shutter speeds up to 1/50 sec. The plain back has a

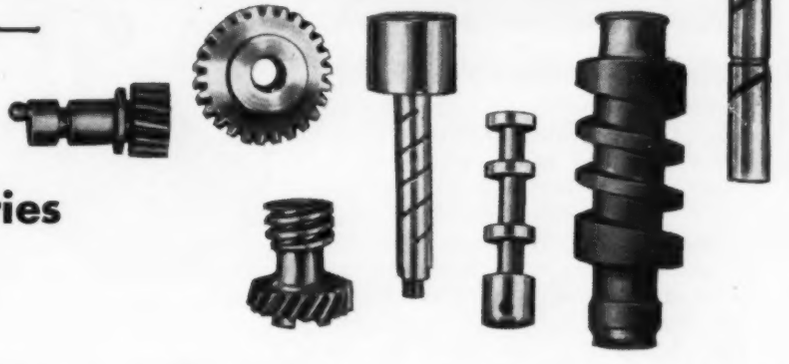


if you want the best in—

✓ machinability

✓ heat-treating properties

✓ physical properties



There's more to J&L Jalcase Steel than a grade number. That's why, if you want the best, you must specify "J&L JALCASE."

- It is the *original*, free-machining, open-hearth steel.
- It still is the outstanding steel in its class today.
- Its machining properties closely approach those of Bessemer steel.
- It machines with a fine finish.
- It is easy to heat treat by conventional and high-speed induction methods.
- It lengthens tool life.
- It reduces production costs.

Jalcase is available in a range of grades to suit a wide variety of applications. It is supplied as cold-drawn or cold-drawn-with-metallurgical-processing, which includes special tempering treatments. Thus many parts made of this material may need no further heat treatment after machining.

Typical Jalcase analyses are found in the A.I.S.I. 1100 series wherein the manganese content is 1.00% to 1.65%, such as in Grades C-1117 through C-1144.

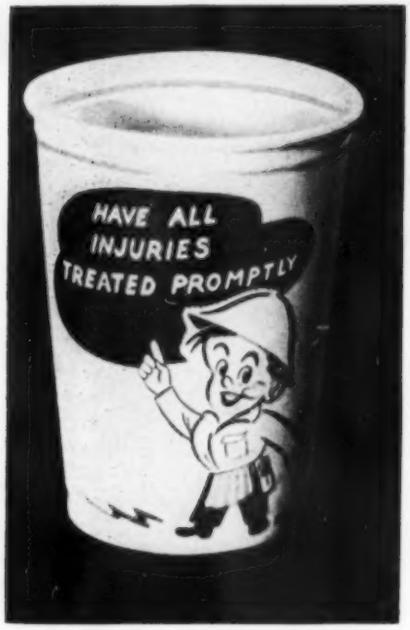
Let us send you complete information on J&L Jalcase—the *modern* free-cutting steel. Write to: Jones & Laughlin Steel Corporation, 402 Jones & Laughlin Building, Pittsburgh 30, Pa.

JONES & LAUGHLIN STEEL CORPORATION

AMERICA'S FOREMOST PRODUCER OF FREE-CUTTING, QUALITY-CONTROLLED STEELS

ground-glass focusing screen and will accept view-camera double film or plate holders. An adapter will permit use of No. 828 roll film.

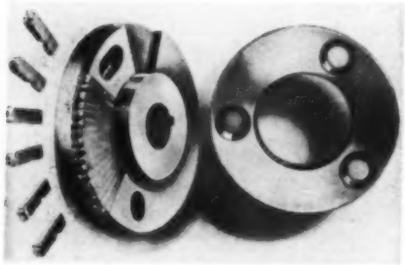
The heavy-metal support base includes storage drawers. The working surface is a linoleum top, and the sliding baseboard travels on stainless-steel rods.



Cartooned Containers Plug Safety

Coffee and caution, in equal doses, help keep workers refreshed and alive by way of cartoon-printed paper cups marketed by Continental Can Company, New York, N. Y.

The cups get into the hands of workers each day and constantly remind them of safety slogans tied in with industrial safety programs. Design, typography, and color can be varied to suit the application, and special cartoon characters have been originated to highlight the message.

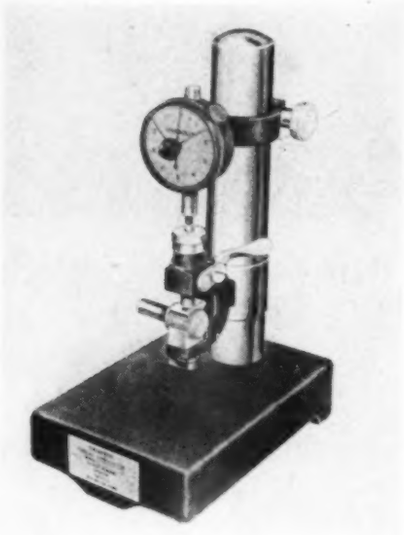


Acme Roll-Type Marking Holders Feature Interchangeable Inserts

The Acme Marking Equipment Co. 8030 Lyndon, Detroit 21, Mich., announces a line of roll type holders which combine the advantages of roller dies and interchangeable inserts. They are also said to assure clear, sharp marking impressions because of a special method used for locking the type inserts in place.

The holders, with interchangeable inserts, are available in any size for use with marking machines or lathes. Rolling the impression on one character at a time is said to provide a greater measure of control. A special feature is a compensator segment with an elongated hole which permits locking lines of any length and does away with the need for spacers.

Style D provides for a single line of completely interchangeable type (as illustrated); Style E provides a double line of interchangeable type and type segments; and Style F, a solid roll die, combines permanent markings with interchangeable type and type segments.

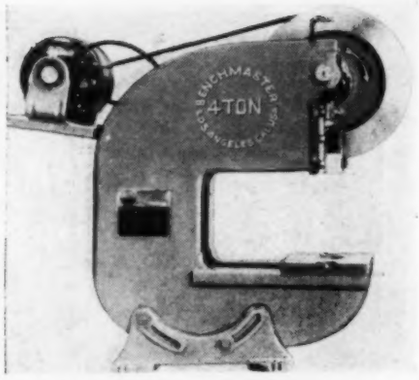


Swanson Thread Comparator Employs Plug and Anvil

National Automatic Products Co., New Britain, Conn., announces the Swanson Thread Comparator for checking threads.

The comparator consists of the stand with indicator and standard thread unit. The setting plug is inserted, the upper anvil is lowered, and the unit is swung under the indicator setting it at tolerance required. A positive swing stop locates the anvil unit in correct reading position.

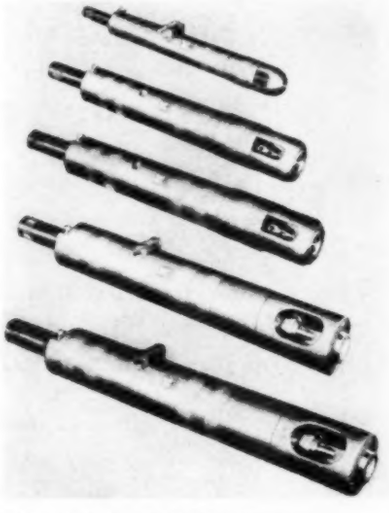
Gage anvils are of gage steel, heat-treated, and ground and lapped to class 4 specifications. Component parts are cast iron, reinforced at points of contact with ground steel parts, hardened and lapped to withstand wear.



Benchmaster Deep-Throat Punch Press Has 4-Ton Capacity

Benchmaster Manufacturing Co., Los Angeles, announces their new deep-throat punch press of 4-ton capacity. Throat depth has been increased to punch to the center of a 17-½-in. circle. The ⅓-hp. press may be used either with or without the 6-in. x 8-in. x 1-in. bolster plate.

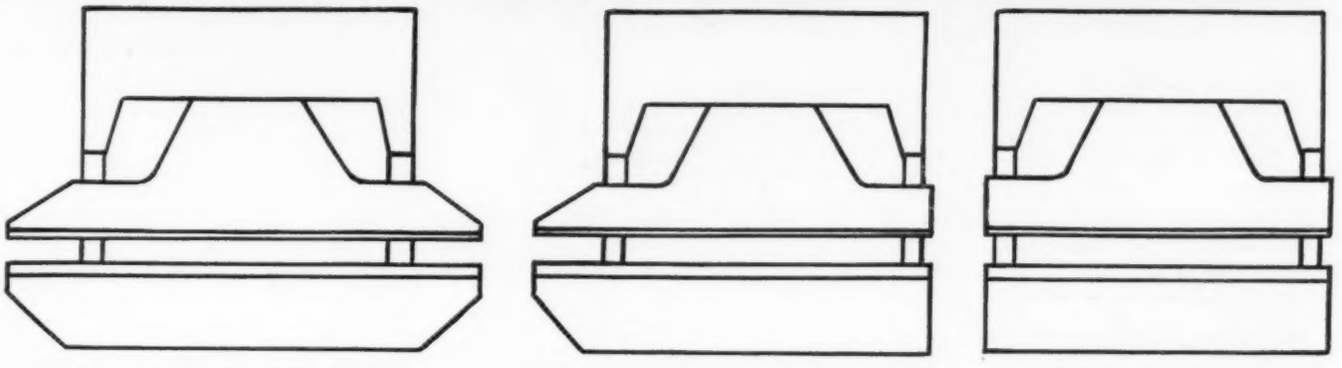
The standard press is supplied with choice of 1-in. or 1¼-in. stroke, although strokes up to 2-in. may be had on special order. The ram position is adjustable and dovetails are gibbed for takeup if wear occurs. All bearings are bronze bushed. Benchmaster's positive, single trip, safety mechanism is employed to engage the flywheel.



Keller Airfeedrill Line Ranges Up to ¾-in. Drill dia. Size

The Keller Tool Co., Grand Haven, Mich., manufactures a line of five Airfeedrill units which combine an air drill, air cylinder and a hydraulic dashpot and feed control.

The tools range from 3½ lb. to 28 lb. in size, and drill holes up to a ¾-in. dia. The five units result in 34 speed combinations of portable and stationary units.



BED EXTENSIONS TO SUIT YOUR WORK

Steelweld Presses are obtainable with various bed and ram extensions. While standard bed machines are most generally used and take care of a wide range of bending, forming and punching work, a single or double bed extension often is very helpful.

Where box-forming or horning operations are carried on, necessitating the bringing of ends of a piece together to form a complete enclosure, a press with an extension on one end is practically a necessity.

Steelweld Presses with double bed extensions are gaining in popularity because, although they cost only a little more, the variety of work that can be produced with them is greatly increased. Such presses can handle sheets 4 to 6' longer (depending on size of machine) than standard bed machines. Deflection is held to a minimum because the support points of both the bed and ram are spaced advantageously.

Steelweld Presses have been adapted to suit many kinds of work by simple changes such as bed extension, bed width and in many other details. Perhaps your press work can be speeded by a machine fitted to your needs.

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CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

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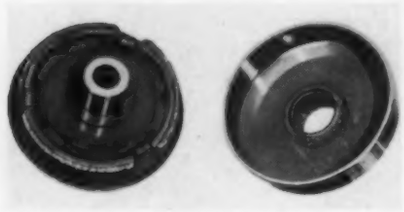
STEELWELD

BENDING PRESSES

BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

Parts and Materials



Saginaw Centrifugal Clutch is Available with 2 or 3 Shoes

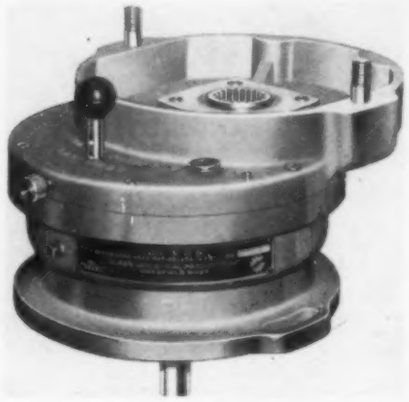
A new Saginaw centrifugal clutch features automatic operation, interdirectional drive, and foolproof construction. Utilizing an expanding, self-energizing shoe, the clutch is suitable for use with electric motors or internal combustion engines, and is especially recommended for small powered units from fractional to 3½ hp., such as scooters, and loading conveyors, that require a high starting torque yet a relatively low operating torque.

Installation in connection with an electric motor permits use of a smaller power source delivering full peak torque, with a consequent improved power factor. Internal combustion engines may be started, warmed up and idled with no load. Driving mechanism assembly allows equally efficient operation in either a clockwise or counter-clockwise direction.

It is available in two- and three-shoe sizes, with 4¼-in. and 5¼-in. drum casings respectively. Each size has a range of engagement speeds from 750 to 2200 rpm. with or without specified size pulleys or adjustable pulleys. Gramix or needle bearings are used for the motor shaft or countershaft.

Air Cylinder by Entwistle Comes in Standard-Bore Sizes

The James L. Entwistle Co., 43 Church Street, Pawtucket, R. I., has just announced production of a standard-use, low-cost air cylinder. It is available in standard-bore sizes from 1½ in. to 10 in. dia., and can be made to any stroke specified. Top operating pressure in 110 psi. The air cylinders are available in five standard mountings.



Olsen Gearhead Doubles Spindle Speeds on Portable Milling Head

Olsen Industrial Products, 40 W. Water St., Wakefield 59, Mass. has developed a two-speed gearhead that is attachable to a Bridgeport Miller Head, and is also adaptable to other types.

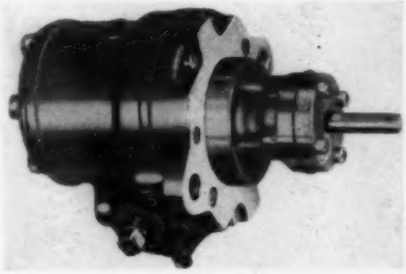
The mechanism is mounted on top of the pulley drive of the miller. Ratios of 1 to 1 and 6 to 1 are possible. The housing is aluminum, and the unit includes ball bearings and hardened gears.

Color-Buffing Composition Treats Burned Chrome, Steel

The Hanson-Van Winkle-Munning Company, Matawan, New Jersey, has marketed a new bar composition designated as 6-B-72, for color buffing carbon steel, stainless and chromium plate.

The composition has a binder that retains the abrasive on the buff face for a greater period of time permitting it to do its cutting, and does not build up a heavy waxy face that prevents a high color free from casts.

A high finish on carbon and stainless steels is produced, and it cuts out imperfections left from the cutting-down operations. It also will rapidly cut and color burned chrome.

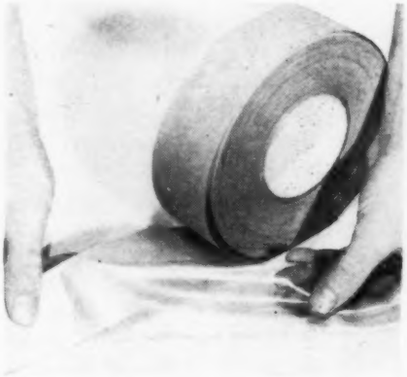


Low-Capacity Pump by Polo For Direct-Motor Type Drive

Model 15 pump, built by Polo Pump Co., Polo, Ill., is designed for direct motor drive at 1725 rpm. and pressures up to 150 psi. It will make a suction lift up to 25 in. of mercury.

Built-in relief valve and strainer are optional on the gear pump. The pump is suitable for supplying oil or coolant, or for hydraulic installations for small quantities of fluid. Capacity is 50 gallons per hr.

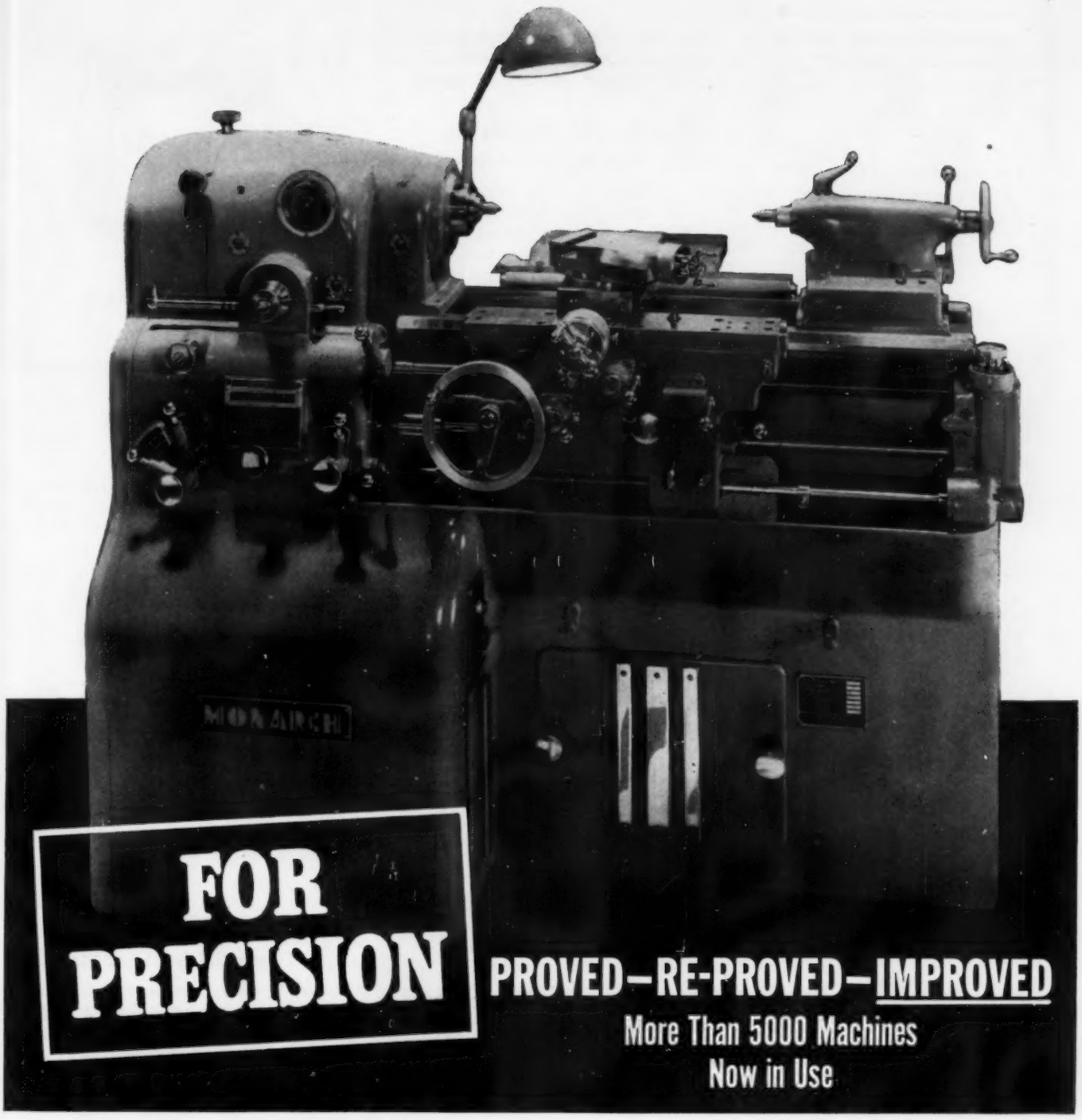
The body is cast iron with a chrome-plated shaft in a long, honed bearing. Shaft seals make packing unnecessary.



Synthetic-Resin Wrap-Rax Tape Resists Chemical-Plating Dips

A new and improved orange-colored Wrap-Rax, a synthetic resin in tape form for insulating plating racks, is announced by the Hanson-Van Winkle-Munning Co., Matawan, N. J. It is effective as a stop-off in hard chromium and other plating solutions.

Wrap-Rax chemically resists all



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PROVED—RE-PROVED—IMPROVED

More Than 5000 Machines
Now in Use

The Monarch Model EE 10″ Sensitive Precision Toolmaker's Lathe

A sensation when it was first introduced in 1938, the Monarch Model EE Toolmaker's Lathe has recently undergone additional design refinements—to give you still more plus values that make this superlative turning machine even better than ever.

Its accuracy, sensitivity and ease of operation are unsurpassed by any lathe, at any price. Outstanding is its wide range of infinitely variable spindle speeds.

Its accuracy is in-built—*and basic*, starting with the famous Flame-Hardening process for bedways pioneered by Monarch more than a decade ago. To this is added induction hardening of lead screws, compound and cross-feed screws—and myriad other design and production refinements, all calculated to give you the most in metal turning. Complete details are contained in Bulletin 302. Write for your copy.

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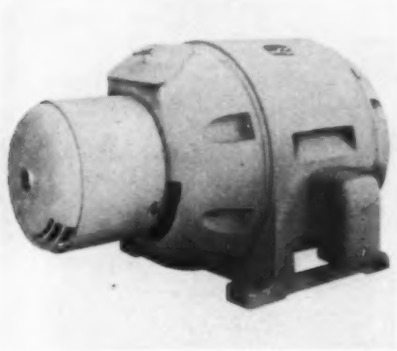
Monarch
TURNING MACHINES

THE MONARCH MACHINE TOOL CO., Sidney, Ohio

FOR A GOOD TURN *FASTER* —— TURN TO MONARCH

cleaning, pickling and plating solutions commonly used.

The tape is claimed to prevent disintegration of plating racks and cut current and metal losses to a minimum. It is furnished in 250-ft. rolls, ¾ in. wide, and can be used on old racks as well as new.



GE General-Purpose Motors Offered in 900 Series Sizes

A new line of general-purpose, Tri-Clad, high-speed synchronous motors and generators in 900-series frame sizes, has been announced by the General Electric Company.

The motors are available in standard ratings from 20-hp to 1,000-hp at 60 cycle speeds of 514 to 1800 rpm, in either two-phase or three-phase types. Generators are available in ratings from 12½ to 1250 KVA.

Of drip-proof construction, the motors incorporate the usual Tri-Clad features. Direct-connected and belt-driven exciters are available for all ratings.

All-Adhesive Tape Bonds Metal With 3500-psi. Shear Strength

Minnesota Mining and Manufacturing Co., St. Paul, Minn., announces a new adhesive that provides a metal-to-metal bond that is resistant to shear tests up to 3500 psi. The "Scotch-Weld" bonding film is transparent, roughly resembles Cellophane, and is marketed in rolls like tape.

The material is not sticky to touch, although it is all adhesive with no supporting film. Bonding is accomplished by placing the adhesive between metal units and curing the assembly with heat—300 to 500 F. for 5 to 10 min.—and pressure—25 to 50 psi.

The material is applicable to metal-to-wood, plastic and fiber bonds, and has attained a shear strength of 3500 psi. with aluminum Alclad. Conventional cleaning prepares the surfaces to be bonded.

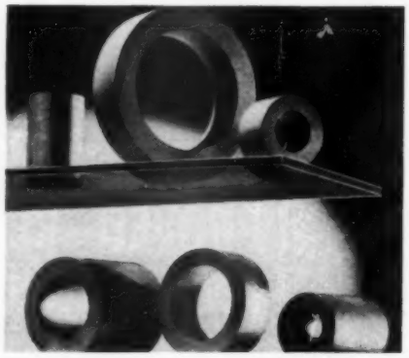
Johns-Manville Markets Air-Hardening Cast Refractories

Johns-Manville has announced the development of two new castable refractories, 3X Firecrete and 3X Blazecrete, for service temperatures up to 3000°F. The use of these fast air-hardening refractories is claimed to offer substantial savings in furnace construction costs because of their adaptability for application by casting, gunning and troweling.

3X Firecrete is recommended for casting or pouring special refractory shapes of all descriptions—burner blocks, door linings, furnace covers, and complete linings.

3X Blazecrete, classified as a castable refractory because it is hydraulically set, was especially developed for pneumatic application in which it is "shot" in place by compressed air with guns. Where gunning is not practicable, 3X Blazecrete can be readily trowelled in place.

Both have negligible shrinkage from application to soaking temperatures of 3000 F and possess unusually high spall resistance.

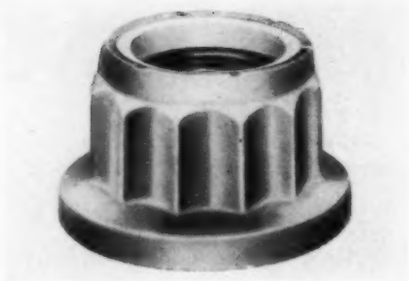


Carboloy Bushings Are Available; Utilized As Wire Guides, Collets

A new line of standard all-purpose carbide bushings has been announced by Carboloy Co., Inc., Detroit, Mich. Various sizes are in use as wire guides, bushings and collets.

Bushings are available in two groups: short sizes from ⅛-in. to 1⅜-in. O.D. and ⅛ in. to ½ in. long; and 11/16-in. to 3-in. O.D. and ⅞ in. to 1 in. long. Some are as inexpensive as 23 cents each.

The smaller group is standard in Carboloy grade 883, and the larger group is standard in the Carboloy grade of 44A.



Elastic Stop Nut Has Reduced Weight and 185,000 psi. Strength

Elastic Stop Nut Corp. of America is producing a new high tensile, double hex nut. The nut (ESNA Type EE) is designed to develop 185,000 psi. minimum in NAS high-strength aircraft bolts where weight and space limitations are major factors.

Completely interchangeable with existing internal wrenching nuts, this new double hex design permits a weight reduction of 66% and a height reduction of 50%.

The nut features a forged-steel body, cadmium-plated and bearing surfaced square with the axis of the threads within 1 degree for nuts 9/16 in. and larger.

Self-locking in any position on bolt or stud. The nut is available in sizes ¼ in. through 1⅛ in. in National fine thread series.

Oakite Cold Solvent Material Cleans Off Paint and Wrinkles

A new, cold solvent material, Oakite Composition No. 15, designed to permit fast, thorough removal of paint and similar finishes from metal surfaces, has recently been announced by Oakite Products, Inc., New York, N. Y.

The manufacturers report the solvent has demonstrated pronounced effectiveness in removing baking japans, wrinkle finishes, nitrocellulose lacquers, and synthetics such as alkyds, phenolics, ureas, vinyls, etc., from such metals as steel, galvanized iron, die castings, aluminum, copper and brass, with no attack on the metal.

The composition may be applied at room temperature by tank immersion methods by swabbing or brushing. This is followed by hot pressure-rinse to remove loosened paint particles. An outstanding use for this material is production-stripping of rejects.

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When you consider the lubrication of that new machine, call on the Bijur engineer, or write for "The Travels of Modern Lubrication." This quarterly bulletin shows how leading machine manufacturers design "built-in" lubrication into their latest models.

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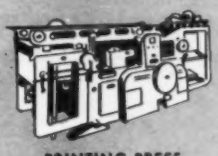

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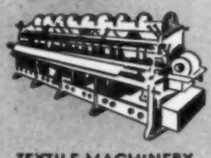

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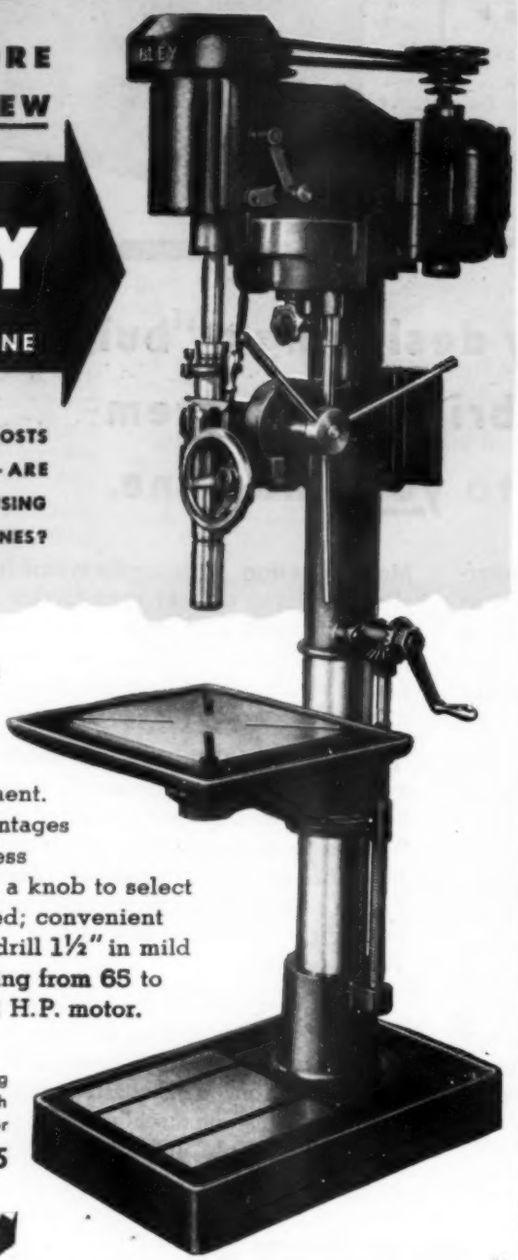

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ROUND TABLE *Discussion*

SWAPPING SHOPS

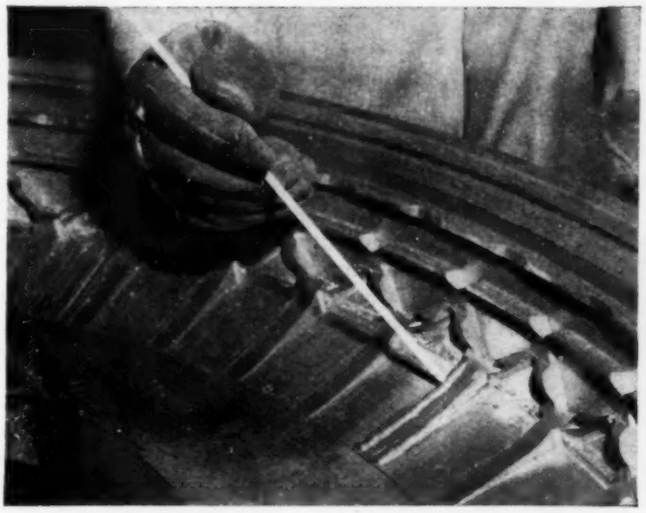
The writer has no knowledge of swapping shops other than that gained as a young man in seeking experience. Is this not the right kind of shop swapping; done at the right time, in the best way and likely to lead to the best results? The kind suggested by Al might have been more useful sixty years ago, but conditions today have greatly changed. Then the individual machinist developed his own methods and to a considerable extent, made his own gadgets. A serviceable product was all that mattered; now time is a factor.

Today operations are planned before production has been commenced; special tools to do the work planned, are provided and the business of the machinist becomes confined to using these in a more or less specified manner, and to give the maximum production possible, consistent with the standards specified. Thus to swap workmen or shops, as suggested, appears to be to put the cart before the horse; surely this is the wrong approach. The workmen so swapped would be able to compare the ideas of the production engineers of the two works as exemplified by operations and tools, but could they do more than report? Quite apart from the reception such reports may meet, it is not human nature to receive, willingly, reports from juniors which may be critical in character.

There can be no argument about swapping ideas and the comparison of methods, but, if our doctrinaire friends would think again, they may suggest the swapping of people on the production engineer's staff; the people who arrange operations; design tools; and it may be, foremen and inspection staff, people who, in the ordinary way, have freedom in arranging their work. The machinists' ideas of methods of production must be affected by the work of the production engineers about which, excepting through the suggestion box, the machinist is a passive individual—he has no say. Swap men by all means. As Al says, to do so would break the monotony and good feeling may follow but "to bring some new ideas back to Papa" presupposes that Papa is a broad-gage man. I remember being a candidate for the sack if "Papa" had found out

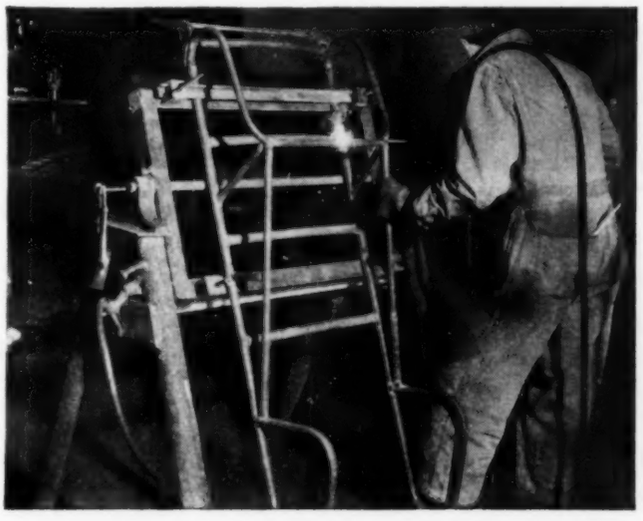
New Electrode Solves Many Welding Problems

Lincoln "Shield-Arc LH-70," for mild steel and hard-to-weld steels, operates in all positions, a.c. or d.c.

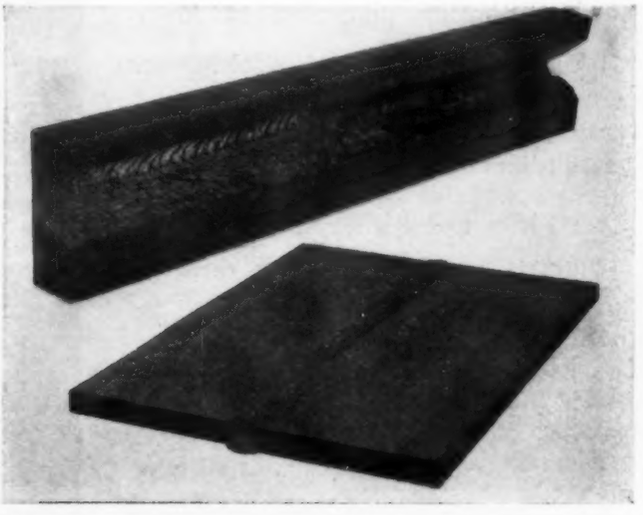


EASILY MACHINED. This manufacturer of tire molds, made of high-sulphur (free machining) steel, has simplified repair work with "Shield-Arc LH-70" because its deposits are easily machined and dense. Ribs in mold shown are being built up along edges due to machining error. Welded ribs will then be machined to proper size.

BANISHES POROSITY. In fabricating sprockets, this manufacturer welds together a disc of mild steel plate and a hub of round cold-rolled stock as shown. Formerly welds were porous; with "Shield-Arc LH-70," they are dense and smooth.



ELIMINATES HEAT-TREATMENT. In the welding of high-carbon, thin-walled tubing, this Company had to use costly heat-treating. This has been eliminated by welding with "Shield-Arc LH-70." Similar benefits are being obtained for high-tensile steels and welds to be porcelain enameled without annealing.



EASY . . . FAST. Many shops are using "Shield-Arc LH-70" for mild steel. On bevelled horizontal butt joints (above), it eliminates need for or materially reduces back-chipping and it can be used with easy straight-drag technique—no whipping required. On down-hand square butts (below), "LH-70" gives 15% to 20% faster welding because of ability to use higher current and get deeper penetration.

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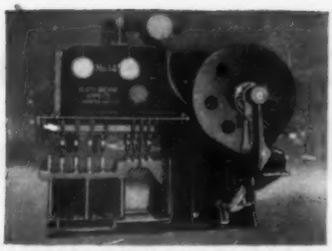

BEATTY No. 14 Toggle Beam Punch for structural steel fabrication.

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BEATTY Hydraulic Vertical Bulldozer for heavy forming and pressing.

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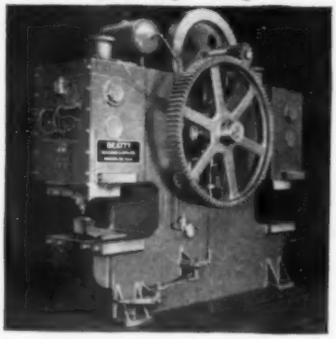

BEATTY 200 ton Double End Toggle Punch.

BEATTY MACHINE AND MFG. COMPANY
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who had sent in a suggestion to the "Office". How dare a mere machinist infer that an improvement was possible, anyhow, anywhere? Has human nature changed?

J. E. Powell
Lincoln, England

•

SHOULD SUGGESTIONS BE SCREENED?

I've worked under foremen who would steal an idea from you before it was ready to hatch, and others so wrapped up in their own ideas that anything in the form of a suggestion would be met by cold rebuff.

One bewhiskered Bull-of-the-Woods set me back on my youthful heels so hard one day that I thought that suggestions from me thereafter would die a slow death. "You candt dell me nuddinks about sewink machines; ven I vont your ideas I'll ask you," were the inspiring words from old sour Kraut as he pointed his finger at me.

A small-shop executive thought that he was the royal clearing house for anything whatsoever between his department and the main office. He'd consider any idea passed over his head as a direct insult to his dignity. . . . Then there was my good-looking foreman back in old Chi. He spent most of his time preening his whiskers and admiring himself in a glass. He would listen to you while you explained your suggestion, then after what appeared considerable thought, would inform you that maybe the thing would work and maybe it wouldn't. In most cases, the suggestion maker would give up in profound disgust.

Now there you have it why secrecy is the ideal of a suggestion system. I would suggest having carbon-backed sheets, numbered in duplicate, so the suggestor could keep his copy for future reference in the event of dispute. I'm in favor of having the numbers of rejected suggestions posted weekly, or monthly. I would also post the numbers of those that have been accepted, with a notification of the person holding the duplicate number to present his copy to the office for payment. Suggestions held in abeyance for further study should also be listed.

It was my pleasure to act as one on a committee of three in appraising the value of suggestions. It is a costly thing to acknowledge every one, although some feel that it is worth the effort and cost. I recall one annoying suggestion coming from one of the employees wherein his idea was to discharge the manager, revamp every system in the plant—he

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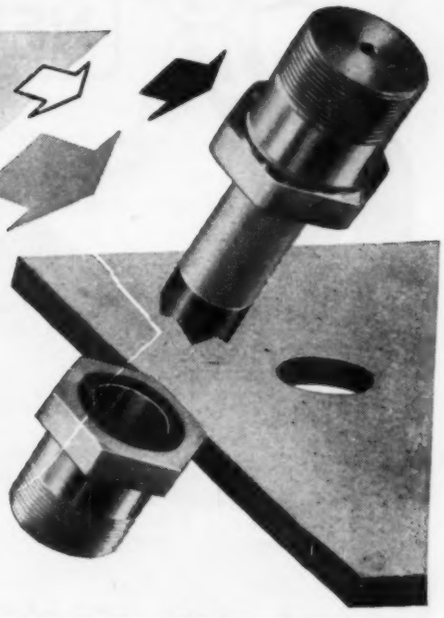

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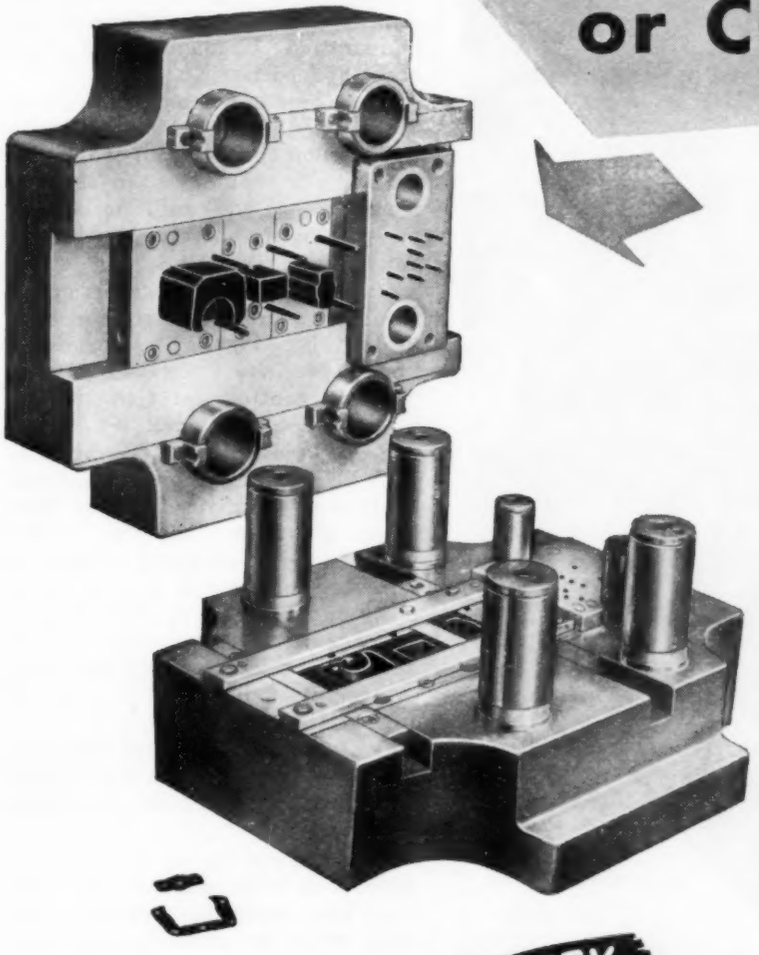

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went into profuse detail—and shuffled the departments around. His idea was to put the steam boiler on the east end of the plant and set the garbage can on the other. The only thing the fellow failed to suggest was to remove the roof! It is for that very reason I am in favor of a notice being posted, above every suggestion box, which calls to the attention of the suggester the disposal clause.

There may be a lot of screwy ideas coming through, but the freedom of thought permitted amply repays for the idea. As a final suggestion: Place the box where the boss cannot see what's going on!

John Homewood
Ontario, Calif.

•

Operation of a successful suggestion system makes the use of the secret suggestion box mandatory. The foreman should not be involved in screening suggestions of his workers. Perusal and judging of submitted suggestions should be under the cognizance of a suggestion committee composed of representatives of administrative, production and engineering departments.

The secret box is to make certain that no prejudice will interfere with the decision on the worth of the suggestion. It should be an entirely secret proposition until decision is made. The foreman or supervisor has no right to conclude that he can control the mental processes of his men. Democratic processes embodied in the operation of the suggestion system preclude the substitution of "thought control" for free and untrammeled suggestions.

If the worker discussed his idea with his foreman before he submitted it as a beneficial suggestion, there is no guarantee that the worker would not be influenced relative to the worth of the idea and the feasibility of submitting it. The foreman might be wrong in his opinion—what he may consider a petty idea may evolve into a beneficial worthwhile suggestion when considered by members of the over-all suggestion committee. Absolute non-interference with the men making the suggestions is paramount.

Improvement in methods, procedures and processes have devolved from ideas submitted directly by the men. When an employee knows he will encounter no interference from his supervisor in making his suggestions, the suggestion system will operate at its maximum efficiency for beneficial results. It will be found that the men are full of ideas.

The actual worth of a suggestion

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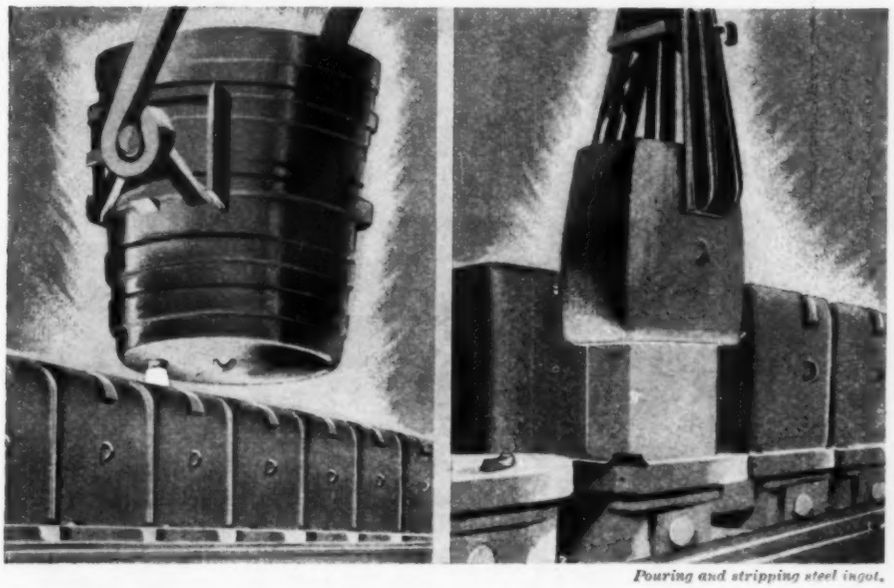

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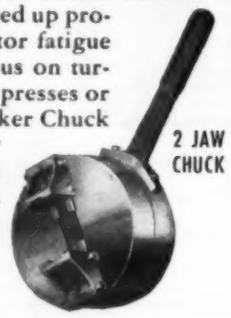

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system probably depends on many factors, among them being the general "idea fertility" possessed by the workmen, the method of reward for suggestions, the method of passing upon them, and the diligence with which the system as a whole is followed up. Experience has shown that the best results are obtained when the workers are permitted to submit their ideas without prior clearance through their foremen, and when they are allowed to have a definite hand in passing on suggestions, through the use of a committee system, or a board which passes upon them.

The appointed suggestion committee, may, if the suggestion affects that particular department, consult the foreman concerned for comment on the suggestion submitted by his employee, but impartiality should be preserved by not divulging the submittor's name until after full consideration is given to the suggestion by the committee.

Harry Kaufman,
Philadelphia, Pa.

•

DO MORALS AFFECT MORALE?

Ed is right. No foreman or supervisor cannot exercise his power as a supervisor when he takes blondes, brunettes and redheads out and paints the town.

A supervisor cannot expect performance from the men under him if he is not living up to the highest standards himself. Also, any partiality shown a worker will be resented by co-workers.

Of course, on special occasions a foreman should show that he is a regular guy and mix and have a good time. But, as far as the job is concerned, it is his duty to see that production is maintained. A good foreman, if he senses that a man is troubled, will do all in his power to help. In this way he will be earning the respect of his employees, and they will do all they can for him.

Michael Axler
Bronx, N. Y.

•

Viewed from the light of experience, there is no doubt in my mind, that morals—or the lack of them—have a definite bearing on morale, whether it be in the shop or outside. Where a shop foreman or supervisor is concerned, the fact of his being in a position of leadership requires that he set an example to the working force under him. If he wants to maintain shop morale at a high level, his con-

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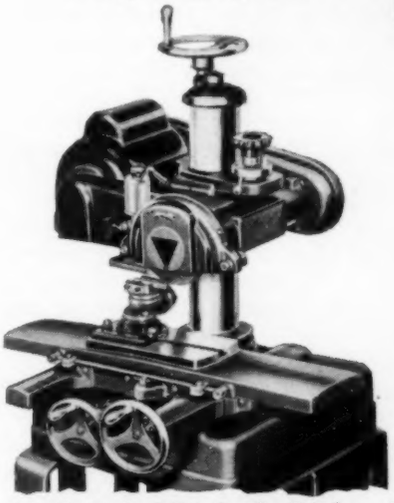
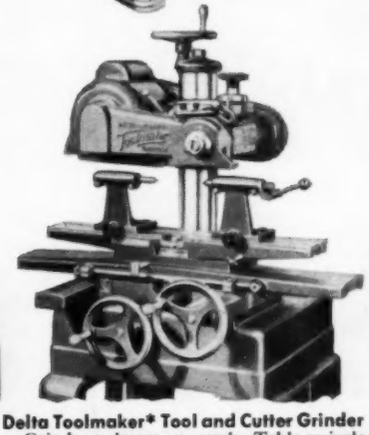


Delta Toolmaker* Chip-Breaker Grinder — For grinding the chip-breaker groove in carbide-tipped tools. Also for grinding form tools, thread chasers, etc. Holds the tool at any conceivable angle. Quickly and accurately reset.



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duct should be—like Caesar's wife—above suspicion.

In the case under discussion, we have a supervisor who plays the Casanova with one of his employees. Right there he loses the respect of the decent element in his working force. The less responsible element in the shop can be depended on to take full advantage of his fall from grace, and the sequel cannot fail to be unpleasant to the supervisor, the women in the case, and definitely damaging to shop morale. I have seen several cases of the type under discussion and the only way to repair the damage was transfer or dismissal of the parties concerned.

So the wise supervisor will treat all his employees alike, both male and female. In the latter case, it will require a little more diplomacy, as the female of the species is quick to notice and question anything that looks like undue attention to the girl on the next machine.

In the final analysis, I would say that good morals are an integral part of good morale. The supervisor with a decent regard for the conventions will seldom have trouble with a mixed working force, all other things being equal.

Robert S. Alexander
Greenville, R. I.

•

An executive has as much right to approach a pretty employee and discuss the weather as any other man in the shop. If he can obtain a date without spending too much time, or attracting too much attention, no one should object or question his intentions. Monopolizing the employees' time or diverting their attention should be discouraged. Using the company's time for courtship or competing with the other employees should also be avoided. Of course, under no circumstances should a married executive date one of his employees.

When an executive dates his employees, he should never discuss it with other employees or other supervisors. An executive can maintain prestige and date his employees if he uses a reasonable amount of discretion. The executive who is in the habit of continuously dating various employees will soon find that, although he maintains silence, his employees will pass the word around. In any event, the executive will soon find himself in the middle.

The executive who has a "crush" on a particular employee and cannot conceal his emotions is doomed. Not only will he neglect his work, but mishandle other employees. If his

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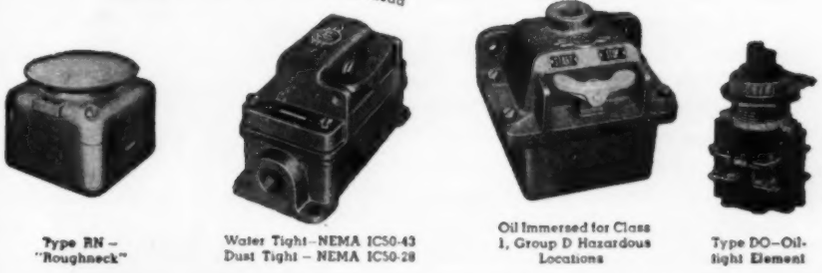
Type RN—the "ROUGHNECK"—has mushroom head, cast metal enclosure with rounded shoulders sturdy enough to take rough usage.

Watertight, dust tight, and oil-immersed types can be supplied. Pendant Stations are also available.

Type EE Push Buttons are for use on ordinary starter applications with contactors or starters up to and including NEMA Size 4, 150 Ampere Size. Available only in standard pressed steel enclosures, finished in Machine Tool Gray, and not subject to modifications.

Type DO is a Heavy Duty Oil Tight Element for mounting in machine tool applications . . . Oil Tight Selector Switches and Pilot Lights also available.

2 Unit
1 Unit Mushroom Head
3 Unit with Hold-down Lock
4 Unit with Pilot Light
5 Unit with Selector Switch
6 Unit with Mushroom Head and Selector Switch
10 Unit and Pilot Light – Selector Switch – Mushroom Head
9 Unit – Pendant Type, Rod Operated Stop
Type EE–Standard Duty



Type RN – "Roughneck"

Water Tight–NEMA IC50-43
Dust Tight – NEMA IC50-28

Oil Immersed for Class 1, Group D Hazardous Locations

Type DO–Oil-tight Element

For every industrial application there's a CLARK Push Button Station available. Write for Bulletin 100.

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favorite is in the habit of flirting, he will exercise his authority to eliminate competitors among male employees.

This problem should be judged by the executive in the same category as "playing the ponies" or participating in lotteries. They are things he should not do, but if temptation is too great, he should exercise caution or suffer the consequences.

Frank J. Zarnowski
Rutherford, N. J.

•

PRESENT OR BRIBE?

So, Al had a birthday present of a wrist watch . . . It seems to me that, instead of beefing about it, Al should consider such an act to be sort of a community affair in which all of his men showed regard for him.

Community affection creates community loyalty and popularity, and all three hold men together around a foreman and make for contentment among them.

True, blisters will arise in any organization and in many cases, diplomacy of the finest type, on the part of a foreman, is required to smooth matters out.

While this may be the first time that Al has had this kind of experience, he may find, that, many times, when some such events as Christmas and birthday anniversaries occur, men, if they are loyal to the firm (and their foreman is loyal to them) will club together, each donate a little money and help make up a sum sufficient to purchase a goodwill present.

On the other hand, some foremen are overbearing, jealous and generally hateful to all of their "subjects." In such cases, a present, now and then, may be the means of saving the jobs of many men.

This class of foremen, and there are many, really try to domineer to such an extent that the men are anxious about their jobs at all times. Then a present is a bribe.

To sum up, a gift, such as Al received, shows goodwill among his men, and he need not feel that he is under any obligation to any particular employee, for this was entirely a free-will proposition.

F. H. Stebbins
Worcester, N. Y.

•

A gift given by a group to its foreman should be an example of a free act of appreciation, but this goal is difficult to attain. The idea may be started by one enthusiastic and thoroughly appreciative person whom

a blade like this

on a machine like this

boosted cutting speed 53%

CUTTING REPORT

Material: 6" dia. No. 94100 steel (equivalent to Temkin No. 5200)
Cutting time with previous blade: 13 min.
Cutting time with Atkins blade: 8½ min.
Increase in cutting speed: 53%

There's good reason why a change to Atkins "Silver Steel" Powersaw Blades so frequently results in sensationally improved cutting performance.

The Atkins "Curled-Chip" Tooth form, with its inward curved face, actually *lifts* the chip free in a smooth, continuous curling motion. Tooth-dulling heat and power-wasting friction are reduced to a minimum. In addition, these blades are made of Atkins own special analysis "Silver Steel" — the steel that was developed to take an edge and hold it through record cutting periods and consistently heavier feeds.

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HY-PRO ENGINEERING increased production from 1,000 pieces per tap to 12,000 pieces per tap

PART: Check nut for air-conditioning fan blade.

PROBLEM: Stringy consistency of 1020 steel caused the 3 and 4 flute taps, used on this job, to pick up and seize often breaking the tap on the 1st or 2nd piece. Production never exceeded 1,000 pieces per tap. Did the Hy-Pro Sales Engineer think it possible to design a tap that would increase output per tap?

HY-PRO SOLUTION: Samples sent to the Hy-Pro Engineering Department were studied and tested. They suggested using a two flute spiral point tap with a special Hy-Pro finish. Manufacturer reports average production per tap now exceeds 12,000 pieces.

Above is a typical example of how the Hy-Pro Sales Engineer can help increase threaded-hole production. His expert engineering counsel backed by the most up-to-date tap production methods combine to solve tapping problems rapidly and profitably.

All Hy-Pro Taps are ground from tough uniform quality high-speed steel and given one of the Hy-Pro exclusive surface treatments.

Each tap is completely inspected by the latest electronic quality control equipment, your assurance that there will be no dimensional variance in Hy-Pro Taps of a stated size.

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Order from your distributor..

HY-PRO TAPS

HY-PRO TOOL CO.

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the group as a whole are glad to follow. But there may be a few of the group who are not at all enthusiastic about the idea and who make no objection for fear of being listed as slackers. Some may be included in the group who are hard-pressed to make ends meet, but feel that they must not show any signs of weakness.

It is not unusual in such a group that there might be someone who does not think the foreman is deserving of any special gift, but will contribute to keep his own standing with his fellow workers good. Neither may he want it known by his fellows or the foreman that his feelings are not those of the group.

The foreman, however, usually knows that such feelings exist, and therefore the gift does not carry the full meaning that it could. While the foreman is appreciative to a certain extent, this situation makes it more difficult for him to treat shop matters and the individual workers in the manner that his better judgment dictates.

Unquestionably a foreman who has received a gift from his workers finds it more difficult to administer discipline when it is deserved.

On the whole, it is safer and more effective for the group to show their appreciation of its foreman by friendship, expressions of good will and in other ways than by a gift. Making an extra effort during a pinch is a good way to do this.

H. B. Martin
Watervliet, N. Y.

•

"Never look a gift horse in the mouth" is a good maxim for the foreman to follow when he is presented with a gift from his men. This is especially true if the gift is given currently and not in parting. The practical foreman will consider the offering as a free-will gift, not as a bribe. He can still do his duty as a boss.

Being a good foreman is not just a matter of being popular. The efficient supervisor knows how to get the best efforts out of his men by being a good administrator. The ability to handle and inspire the men under him and increase their output and usefulness is the essence of his good leadership. If these qualities in a foreman result in an outward manifestation of the workers' esteem in the form of a gift, it should be accepted with alacrity by the fortunate foreman.

When a foreman is held enthusiastically in esteem by his men as a good supervisor to work for it is

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Type HO-1

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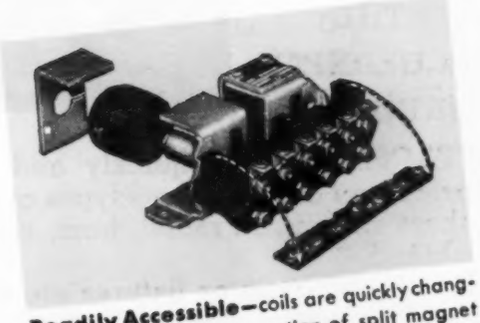
- √ **Ratings:** AC single phase, ¾ HP, 115 V, or 230 V; AC three phase, 1 HP 220, 440 and 550 V; DC, ¾ HP 115 or 230 V.



Readily Accessible—coils are quickly changed by removing lower portion of split magnet frame. Electrical interlock bar (shown removed) easily added for 3-wire control applications.

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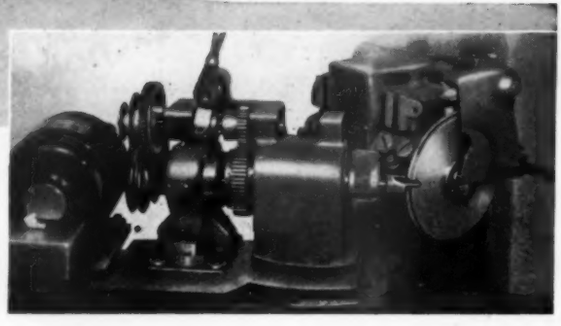

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usually because he is "in there pitching for the men." A gift from his men should be unnecessary to foster loyalty on the foreman's part. Loyalty begets loyalty, and the "pitching" type of foreman is usually the favorite and successful leader. The foreman should carry out his duty as a boss and be honest and fair with his men whether or not he accepts their gift. It should be equally unimportant to him whether all of his men contributed toward the gift. An enthusiastic and loyal force is the result of such leadership.

Harry Kaufman
Philadelphia, Pa.

•

There is nothing wrong with the theory that a foreman is expected to be loyal to top-management policies. Management has a right to expect this loyalty, and a foreman has no right to feel irritated when he is called on to break off making machines, and to help sell Victory bonds, collect for the Community Chest or some other worthwhile cause. But in the case cited, Ed is expected to help diffuse information to combat a rumor that his company's profits are excessive. Asking Ed's help in this case doesn't make sense to me, and it won't to the men.

Information regarding company earnings, if it is to be effectively used as propaganda, should not be disseminated by a messenger boy. It has to be done from the top, from the president, or an assistant of his. It is definitely not a job for Ed.

James K. Matter
Detroit, Mich.

•

While I hesitate to thrust any more details on the shoulders of the overburdened foreman, I rather like the idea of Ed carrying the necessary information to his men—that is, if Ed is the right foreman type. Some executives are so untactful that any effort on their part to disseminate company news could result in misunderstanding. If the foreman is the type that commands the respect of the men, a short session devoted to company news flashes wouldn't result in better understanding between employee and employer. The foreman's part in spreading company information is of course subordinate to the activities of a specialist whose knowledge of industrial psychology is beyond reproach. In a small successful business one will find the

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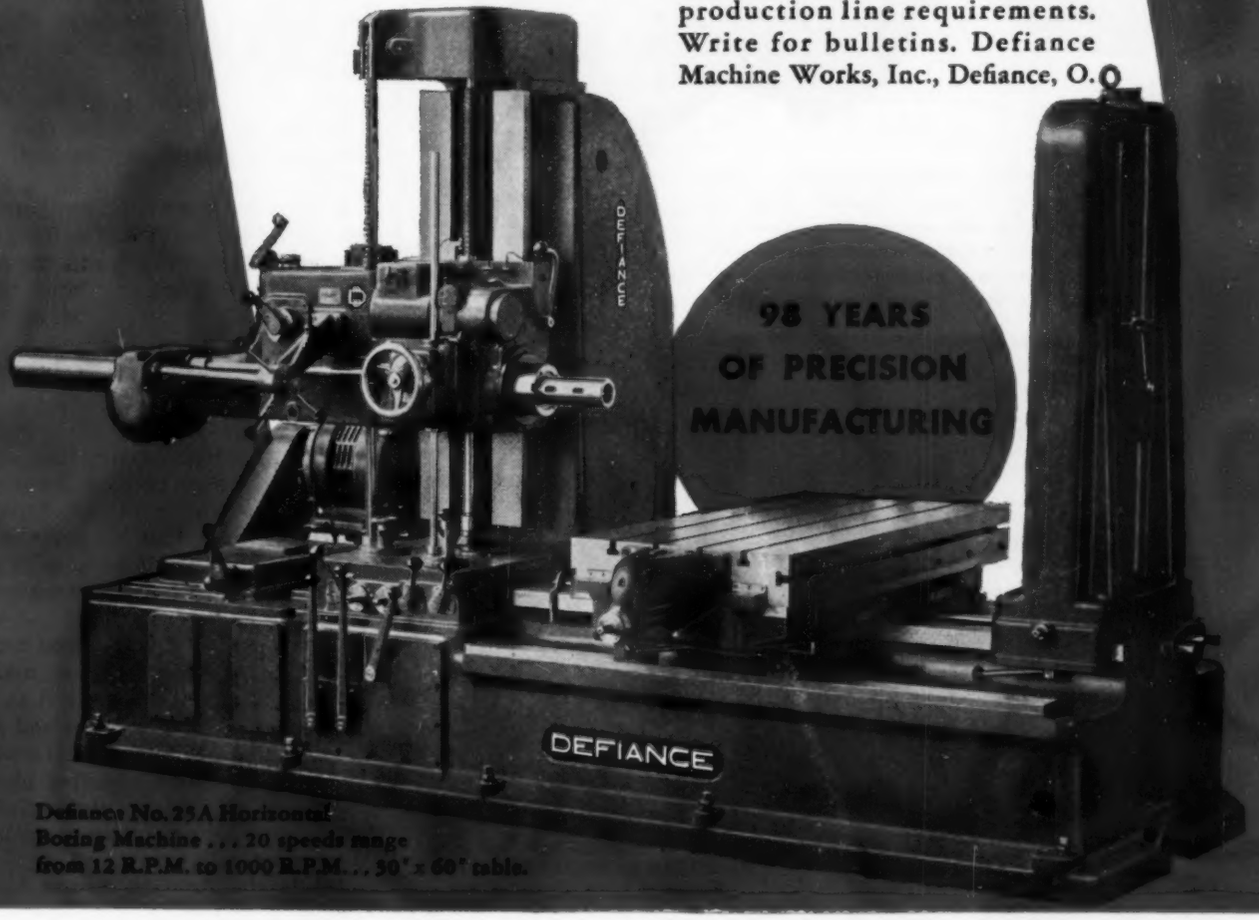

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John Homewood
Ontario, Calif.

•

The foreman level is just where company relations should begin—but seldom do. How many times have you and I seen the Brass give a lengthy discourse of the Gold Question, economics, and abstract drivel away over the heads of the help who are interested in everyday language as to what is what?

How many times have you seen the rank and file underpaid and sweating it out day after day—then some morning they read in the papers that their employer has given away to some remote college or library a big chunk of dough they earned for him?

The Brass should, by all means, convey the true story of company finances and policies to the foremen and ask them to tell it to the boys at the bench or machine. The foreman is in a better position to tell the story and tell it in shop language without a lot of charts, doodads and what-have-you.

Let the foreman read the communique by all means, but give him the details and policy back of the notice.

Let the Brass build up a reputation for telling the truth and nothing but the truth; then the boys in the shop will be playing on the same team.

M. Murphy
Lakewood 7, Ohio

•

Foremen's duties occupy the space between the shop and the lower step of management, and no foreman should consider that his place is being fully filled if all he does is give orders to the workmen and supervise their work.

It is quite well understood that a manufacturing concern must make a substantial profit to enable it to pay fair wages, keep up repairs and plan growth. However, many of the working force have but a limited idea of the many necessary outgoing channels that cause a continuous drain on these profits.

While the foreman would hardly

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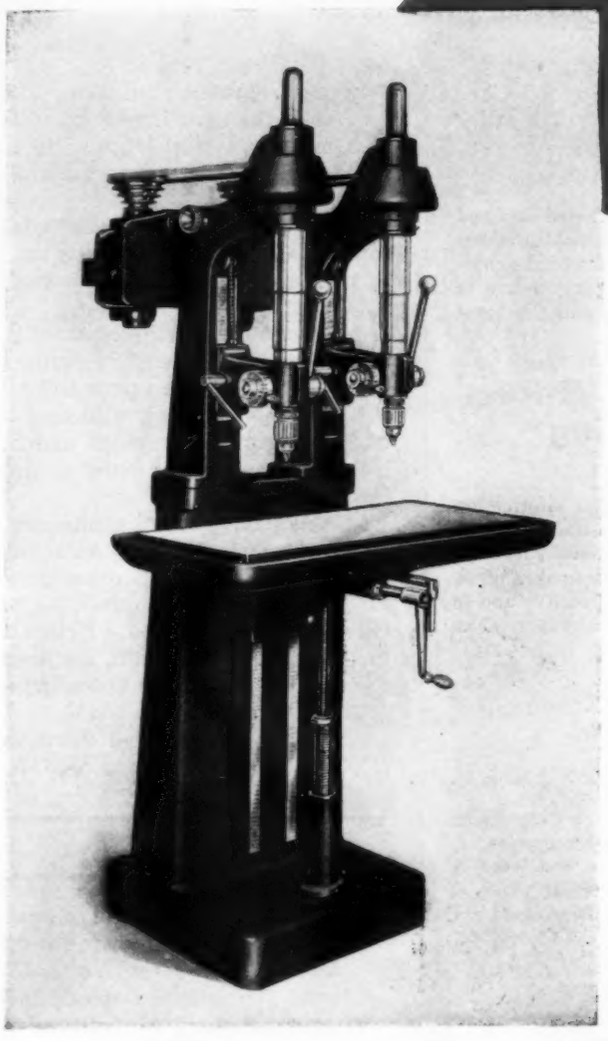

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988 working drawings, with concise explanations, show you at a glance what you want to know about the design and construction of any piece of tooling equipment. Here is a wealth of up-to-date useful data not only on jigs and fixtures but also on machine tools, diemaking, plastic molding, welding and allied tools and procedures. A very handy reference for production department personnel as well as toolmakers.

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By Paul Schwarzkopf and Associates

The inventor of the multi-carbide hard metals, new sintered iron and steel products, and many of the other powder metallurgical products and processes presents here the first complete explanation of the characteristics, industrial processes, products and underlying theory of metal powders. A wealth of production information and the latest postwar developments are included.

How to get your good ideas into production the best and easiest way.

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This book by two expert toolmakers gives you the latest information on the methods and materials for the design and construction of all types of punches and dies used for fabricating sheet metal, together with clear how-to-do-it instructions. One tool and die maker of 30 years experience wrote that he found the book so informative and so interesting that he sat up nights reading it! Full reference tables are included.

Increase your production and profits with successful supervision.

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By Auren Uris

Conversations between a new foreman and his fellow workers bring out in specific, down-to-earth terms everything that a production supervisor must know to be successful and how he can best learn it. Foremen and top management people alike have put their stamp of hearty approval on this book as one of outstanding helpfulness and benefit to all concerned.

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be expected to answer all these questions of financing, there is much he can do to ease tension. It gives workers peace of mind and a degree of satisfaction when they have a foreman to whom they can go for information regarding such matters. Their confidence will be held if the foreman either answers their questions or finds out from higher sources what the answer is.

In the case cited, Ed is creating a skeptical feeling rather than relieving it.

A printed statement of financial conditions is a good thing to be presented to the shop. However, such a proceeding is bound to bring up some questions and they must be answered to keep peace in the shop.

Abel Blakeman
Watervliet, N. Y.

•

Company relations with the workers are one of the most important phases of a foreman's work. Since he is a go-between of labor and management, it is his task to pass messages back and forth, and because of his constant contact with men, he can do this better than a specialist and without interrupting production.

A specialist is usually a college man who is not familiar with the shop lingo or the men personally. He is likely to waste time with one who tries to "string him along" and neglect the man who is slow to grasp ideas.

Workers have more confidence in a foreman than they have in a white-collar man. In case a worker doesn't fully understand a subject, he will not usually hesitate to question the foreman again and again, but he will likely nod "yes" to the specialist and let it go at that.

Frank J. Zarnowski
Rutherford, N. J.

NEW BOOKS

ELEMENTARY & APPLIED WELDING—*By Herbert P. Rigsby, Dep't of Mechanical Engineering, and Chris Harold Groneman, Dep't of Industrial Education, Agricultural and Mechanical College of Texas. Published by Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis. 151 pages. Price $2.*

Designed especially for the student in the art of practical welding, this book outlines the equipment necessary for general welding operations, describes the purpose of each item and the method of using it.

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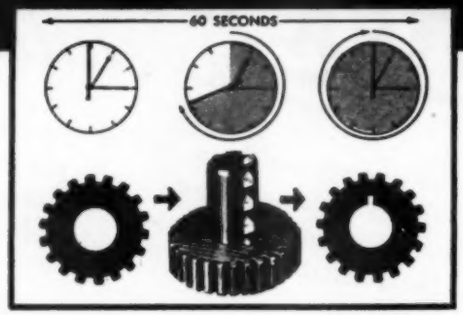

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Gas welding with and without filler rod, and flame cutting are described, with instructions on how to proceed with each step. Arc welding is also considered in a similar manner, and the various types of welds are described.

The remainder of the book is devoted to detailed instruction on how to make a wide variety of useful and ornamental objects for welding practice.

•

INTRODUCTION TO TOOL ENGINEERING—*By Halsey F. Owen, M.E., A.S.T.E., Associate Professor of Industrial Engineering, Purdue University. Published by Prentice-Hall, Inc., New York, N. Y. 145 pages, 6x9 in. Price: $3.60.*

The gradual switch from tool application by the shop mechanic to formalized design and development of mass-production devices by specially trained engineers had produced a relatively new division of production job—tool engineering.

Starting from categorical explanations and definitions of manufacturing methods and machine tools, the author builds a background of industrial information that is valuable to both students and experienced engineers. Shop practices and routing are examined, and methods of designing for production of varying rates are taken up. Other chapters are concerned with tool design, manufacturing costs and economics, and selecting the best tools and manufacturing methods for the individual case.

Although the book is primarily a text for student engineers, it may be read by shop men to obtain an understanding of how tooling must be set up to produce most economically.

•

HOW TO DRAW TECHNICAL ILLUSTRATIONS—*By Linsley and Hawkins. Published by Studio Publications, 381 Fourth Ave., New York 16, N. Y. 64p. Price $1.*

Written for the beginner in the art of drawing technical illustrations, this book explains the purpose and value of perspective drawings and shows how to proceed from the preliminary layout to the finished job. Instructions are given on how to position the work to show the desired features and to show shadows and highlights, and how to arrange the drawing for the most pleasing effect. Other subjects covered include shading, sectioning, lettering, and the various techniques that can be employed.

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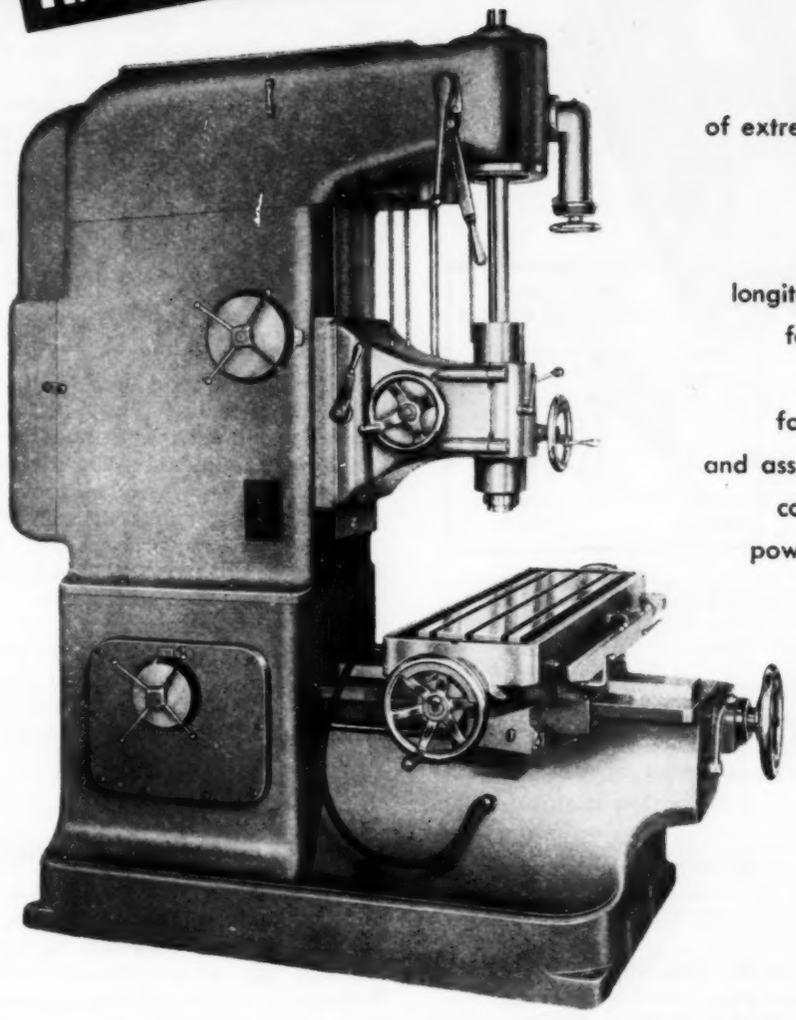
INCREASE PRODUCTIVE TIME

No. 50 PRECISION BORING AND VERTICAL MILLING MACHINE



Combined in a single solid-base machine of extreme capacity — every feature for precision boring and accurate milling!

In the No. 50 are exceptional cross and longitudinal table travel plus long spindle travel for handling an extensive range of work — rugged, rigid bed-type construction for fast, heavy cutting — precision manufactured and assembled for positive accuracy — convenient controls for easy, effortless operation — and power to spare for the heaviest, toughest jobs.

With far greater range than other machines of comparable size, the No. 50 is an assured investment in reduced costs and more profitable production

Send For Complete Catalog Details

Sixteen Spindle speeds, 40 to 2000 r.p.m. ● 9 Spindle feeds, .005" to .010" ● 100" table traverse per minute in both directions ● 16 Table feeds, 5/16" to 20" per minute ● 7½ h.p. Drive

W. B. KNIGHT

MACHINERY COMPANY

KNIGHT VERSATILE MILLERS ACCURATE-RIGID

MORE GOODS for MORE PEOPLE at LOWER COST

3920 WEST PINE BLVD. • ST. LOUIS 8, MISSOURI

For better tooling at reduced cost

WENDT-SONIS carbide tipped *adjustable* REAMERS

Design of Wendt-Sonis Adjustable Reamers assures outstanding performance of reaming operations. Cuts are smooth and true to close tolerances. Generous chip clearance allows maximum stock removal. Only selected materials, carefully heat-treated, are used in W-S Adjustable Reamers.

REPLACEABLE CARBIDE-TIPPED CUTTING BLADES — A new tool can be had by replacing worn blades. One piece of carbide, heavily backed with high speed steel, runs the full length of blade. Diamond lapped cutting edges insure free cutting action — longer life.

ADJUSTABLE TO CLOSE TOLERANCES — Threads precision ground from the solid permit close blade adjustment. Maximum expansion allows greater number of re-grinds per tool. Special safety lock-nut permits easier replacement and positive locking of inserted blade.

AVAILABLE IN THREE STYLES — Straight shank, taper shank and shell type for reaming any type of material. Also available in right and left hand spiral flutes in straight and taper shank styles. A wide range of sizes for almost every reaming job.

Write for W-S Catalog No. 646 Revised

Contains complete details and latest prices on W-S Adjustable Reamers. Write: WENDT-SONIS COMPANY, Hannibal, Missouri; 580 North Prairie Ave., Hawthorne, Calif.; 1361 West Lake St., Chicago, Illinois. Warehousing Facilities: Eastern Carbide Corp., 909 Main St., New Rochelle, N. Y.

WS

WENDT SONIS

CARBIDE CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS
DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS
ROLLER TURNING TOOLS • SPECIAL BITS

TO THE EDITOR

Capacity of Form-Planing Job Upped to Full Machine Width

Here is a revision of the idea on profiling (page 113 of the July 1 issue), using a planer for brake-die and forming work: Set up the templet or form on top of the cross-rail. A permanent fixture can be set up to hold it if a quantity of work is to be done this way. The feedscrew must be removed to allow the head to move freely in the ways.

A yoke may be made to straddle the back casting of the head and can be bolted and doweled to the toolslide. A roller or wedge-shaped follower can be installed to ride the templet, and this can be mounted with a screw for adjusting purposes.

If necessary, a spring may help hold the roller to the templet. The full capacity of the machine width can be employed for large jobs in this manner. *James S. Lunceford, Odissa, Mo.*

•

Borax Coat Eliminates Scaling

"Painting" Cuts Heat-Treat Scale by Roger Isetts in the July 1 Practical Ideas department is effective but it slows down production. The mixture of lampblack and linseed oil prevents scaling, but introduces carburization.

A more common practice is to dip the part in ordinary borax when it is heating up. The borax melts and forms a complete covering "skin," and it has the additional advantage of eliminating the carburizing effect.

When the work is quenched, the skin breaks off and the part is clean. *Michael Axler, Bronx, N. Y.*

•

Locating Idler Gear by Formula

The trigonometric solution given by Mr. Dunlap (*AM*, Aug. 12, 1948, p. 127) as simpler than my algebraic solution has several disadvantages. Evaluation of small angles where their sines and tangents are nearly equal leads to inaccuracy. Moreover, interpolation of sine tables is not accurate for exact values.

The algebraic solution involves no such approximations. It may appear to be more involved, but the end result is one equation which can be applied to all cases. This is an advantage when there are a number of such locations to make or where it is done often. *Henry L. Ahner, Flushing, L. I.*

"Quotes"

Better Human Relations Require Enlightened Personnel Administration

"THE OPERATING MANAGEMENT is responsible for good industrial relations and personnel administration. The personnel or industrial relations department is responsible for developing and perfecting the personnel tools which that management needs to do the job." Thus did Mr. Lawrence A. Appley (president of the American Management Association) define the relationship between these two sectors of management in an address before the Southern Industrial Relations Conference at Blue Ridge, N. C., July 21.

Continuing, Mr. Appley said, "The carpenter uses a saw but he doesn't perfect or manufacture it. Secretaries type but they didn't discover, invent or manufacture typewriters. That management which asks and expects the line supervisors, foremen and executives to carry out the responsibilities of personnel administration without the help of a carefully selected and highly trained personnel department will soon be observing the farmers at work with oxen-drawn wooden plows. You can't have better human relations without greater skill in the development of better and better methods anymore than you can have better products without a research laboratory and bureau of standards."

Supporting these conclusions Mr. Appley emphasizes that "a review of the commonly accepted activities of industrial relations and personnel administration would indicate that they are *all* for the purpose of accomplishing the objectives. . . . outlined." These are, "determining the proper organizational structure with which they (management) can operate most efficiently; determining the qualifications of individuals to fill the positions in that orgnization; making accurate and intelligent inventories of the human resources which they have; discovering ways and means by which they can secure greater productivity from the individuals on their payrolls; developing and maintaining adequate sources of competent human resources for the future; maintaining adequate supplies of supervisory and executive material; maintaining a high degre of morale which is frequently called the will to produce."

NOW AVAILABLE IN 5 SIZES

WENDT-SONIS

CRITERION

BORING HEADS AND SHANKS

New, more complete range of sizes makes W-S Criterion Boring Heads and Shanks readily adaptable to a wide variety of machines and jobs. Heads have threaded backs which can be fitted with interchangeable shanks. The clearly calibrated lead screw is of heat treated alloy steel, with threads ground from the solid AFTER HARDENING. Adjustments of .0005 or less are easily made. Criterion head lengths are held to a minimum to give greater tool rigidity and assure smoother, more accurate boring. Heavy roughing cuts as well as accurate finish cuts are possible. Bar holder may be locked in position. For longer life and continued accuracy insist upon CRITERION.

FREE NEW W-S CRITERION CATALOG
Contains latest data, sizes and prices.
WRITE: Wendt-Sonis Company, Hannibal, Missouri; 580 North Prairie Ave., Hawthorne, Calif.; 1361 West Lake St., Chicago, Illinois. Warehousing Facilities: Eastern Carbide Corp., 909 Main St., New Rochelle, N. Y.

WENDT SONIS

CARBIDE TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL BITS

Central system clarification of coolants gives.... money-saving advantages

A central system featuring Honan-Crane Automatic Clarifiers and Houdaille Conveyors delivers a continuous flow of clean coolants to any number of machine tools. Chip and contamination disposal problems are fully solved. Operating economies more than justify the expenditure for this equipment.

NOTE: Other types of central systems for cutting oils, hydraulic oils, rolling mill oils, etc., feature Honan-Crane Purifiers, Filters and other items of equipment. Write for case histories on actual installations.

1. Increases tool life
2. Eliminates Individual machine tool coolant pumps and motors
3. Better finishes with fewer rejects
4. Eliminates labor necessary to clean individual machine tool sumps and lines
5. Extends coolant life thereby relieving disposal problems
6. Better control of Dermatitis problems

HONAN-CRANE AUTOMATIC CLARIFIER . . . This clarifier removes abrasives, dirt and other solid contamination from water soluble coolants used for grinders, broaches, boring machines, milling machines and other metal working machine tools.

THE *Houdaille CONVEYOR . . . This effective conveyor is the final step in eliminating manual labor requirements for oil and coolant clarification systems. The chain and flights which travel through standard 2", 4" or 6" pipe are routed along the bottom of a V-shaped settling tank. An open section of pipe is employed at this point. Chips, sludges and other contaminants are collected, as they settle, and are transported over any required route of travel to a hopper for disposal. A sludge cart may be used to move the sediment for final disposition. Flights are neoprene, steel backed. The conveyor is driven by an electric motor, through reducing gears.

*Pronounced Hoo-dye

HONAN-CRANE CORP

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- ☐ Please send actual case histories on Central Systems for _____ for _____ (Oils or Coolants) (Type of operation)
- ☐ Please send complete information on Automatic Clarifier
- ☐ Please send complete information on Houdaille Conveyor
- ☐ Please have a salesman call

Name _____

Company _____

Address _____

City _____ State _____

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HOUDAILLE-HERSHEY
CORPORATION

These Threads are too shallow

These Threads are too deep

These Threads are just right

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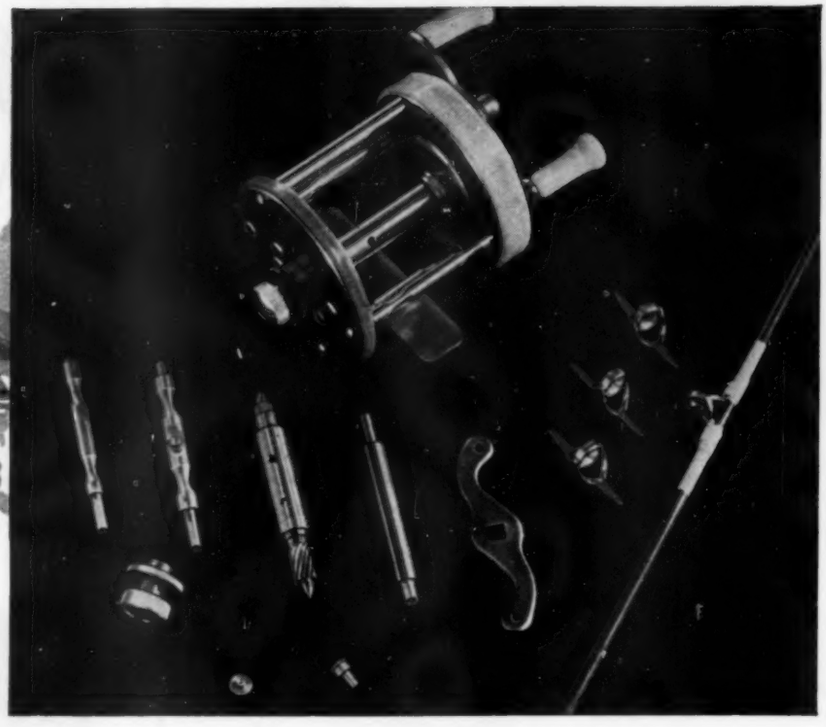
. . . they are CIRCLE Ⓑ BOLTS

Free-Machining
ENDURO STAINLESS STEEL



...Selected for Reel Quality-Plus Economy

Corrosion-resistance is a primary requirement in any fishing reel. So, too, is precision machining for smooth, dependable operating characteristics. That's why many reel manufacturers use ENDURO Stainless Steel.

ENDURO Cold Finished Bars are processed by Republic's Union Drawn Steel Division with an eye toward efficient, economical production. *Close tolerances, accuracy of section, UNIFORM MACHINABILITY, uniform soundness and fine surface finish* combine to keep unit costs and reject losses to welcome low figures.

Whatever *your* product requirements—eye appeal, corrosion-resistance, ease of cleaning, sanitation or extra long life—remember that you can get *PROMPT DELIVERY* of ENDURO Stainless Steel Bars—cold finished or hot rolled—and wire. Write us *today.*

A VALUABLE AID FOR MACHINISTS

It's a handy Speed and Feed Selector to help you in machining stainless steel. Send for one TODAY . . it's FREE.

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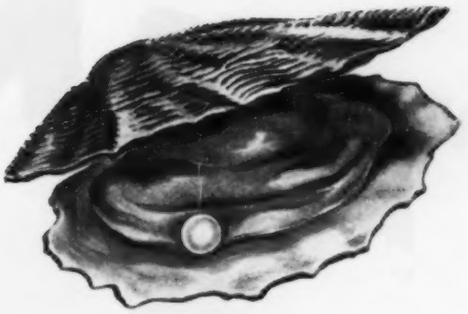
STAINLESS STEEL

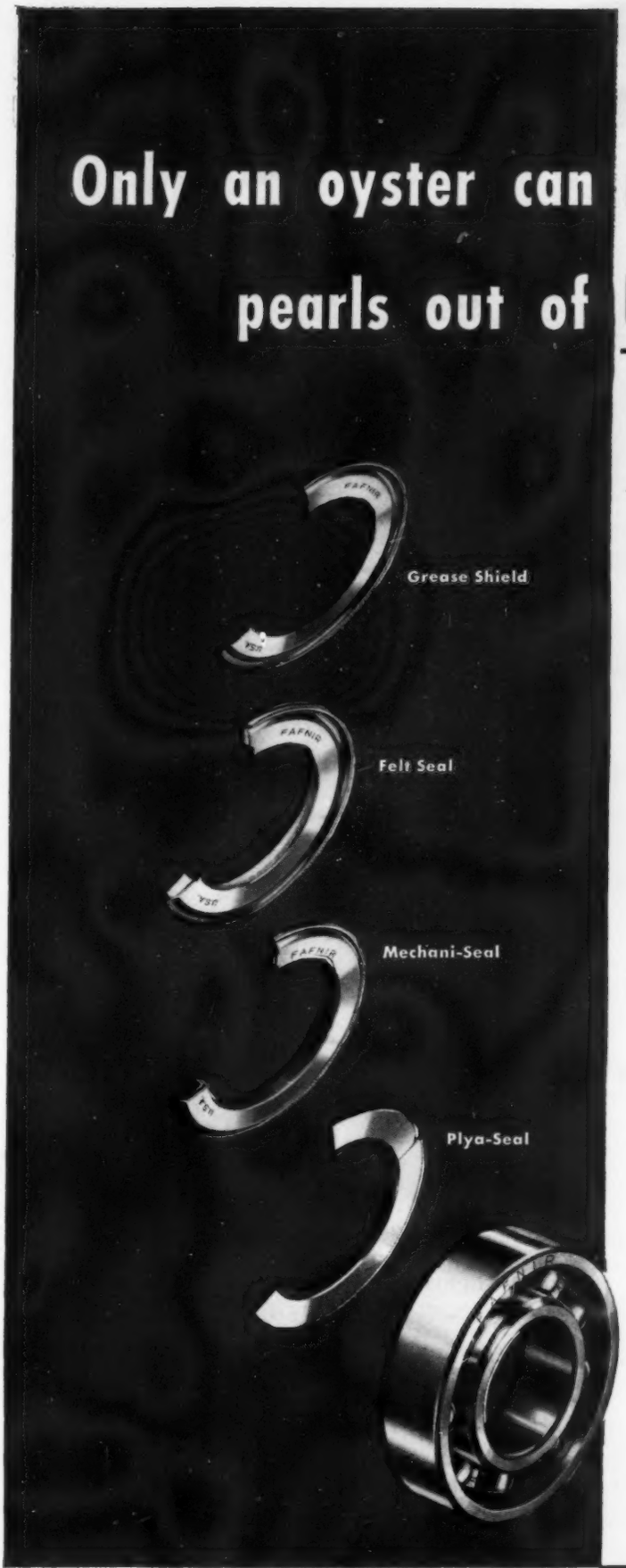
REPUBLIC STEEL

Other Republic Products include Carbon and Alloy Steels—Pipe, Sheets, Strip, Plates, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing

Only an oyster can make pearls out of GRIT



When an oyster yawns too wide and gets some grit in the works, it goes into the jewelry business... making pearls. But grit inside a ball bearing puts it out of business. And the conditions of an oyster's life are nothing to what a ball bearing has to put up with in construction machinery, airplanes and in textile mills and chemical plants. So devising "shells" for ball bearings to crawl into was a natural for Fafnir pioneering... beginning more than twenty years ago.



Survival of the "fittest"

In order for these seals and shields to keep lubricant *inside* the ball bearing and lock dirt *outside* they must be fitted to thousandths of an inch . . . yet the bearing must be left free-moving, unencumbered. And in the latest Fafnir development, the Plya-Seal, even this infinitesimal clearance has been abolished. It's a "wiping contact" yet the bearing's free as air. One of these bearings carries this evolution an interesting step further: it includes a grease chamber which provides lubrication for years and years of maintenance-free service. Today Fafnir-designed ball bearings can take almost any condition that industry throws at them . . . brine, steam pressure, desert heat and polar cold, dripping moisture and clouds of acid and alkali.

Need some ingenuity and interest?

Could be, there's no place in your machine for these Fafnir protected ball bearings. But there's certainly a place in your product planning for the kind of ingenuity and interest that produced all these variations on a basic theme to meet specific problems in various industries. That's the point... Fafnir's experience is not limited to just one or two industries but is industry-wide. The Fafnir Bearing Company, New Britain, Conn.

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BALL BEARINGS

"PANORAM"

...an inspired name for a wide-vision

SAFETY GOGGLE

...and this AO Product is better than its Name!

This popular plastic goggle pleases both the worker who seeks sure protection *over* his prescription glasses and the man who needs protective goggles *only*. The *replaceable* lenses provide full, wide-angle vision and with the lightweight frames, may be had either clear or in green acetate. There's overall comfort in frames closely conforming to forehead and face . . . a bridge which fits any nose without irritation or pressure . . . eyecups vented to reduce fogging of lenses. Your nearest AO Representative can give you full information about the Panoram Goggle for combating hazards common to chipping, grinding, riveting and similar operations.

American Optical COMPANY *Safety Division*

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Apex Insert Bits do MORE for LESS

Whether you use Phillips, Slotted, Clutch Head, Frearson, Hex Head or Socket screws—it's all the same to Apex.

Apex Bit Holders do a big job with a minimum inventory. You merely get the Bit Holders you need for *your* drivers—then simply order new tips as needed and discard the old ones.

Holders accommodate the short, money-saving bits in a full range of sizes. Holders are furnished for practically all makes of power and spiral drivers.

For hex head screws each replaceable, long-wearing socket has *two lives.* Use one end till it is worn, turn end for end—and you have a new socket.

Catalog No. 20 gives all the facts. Write for it.

APEX insert type bits

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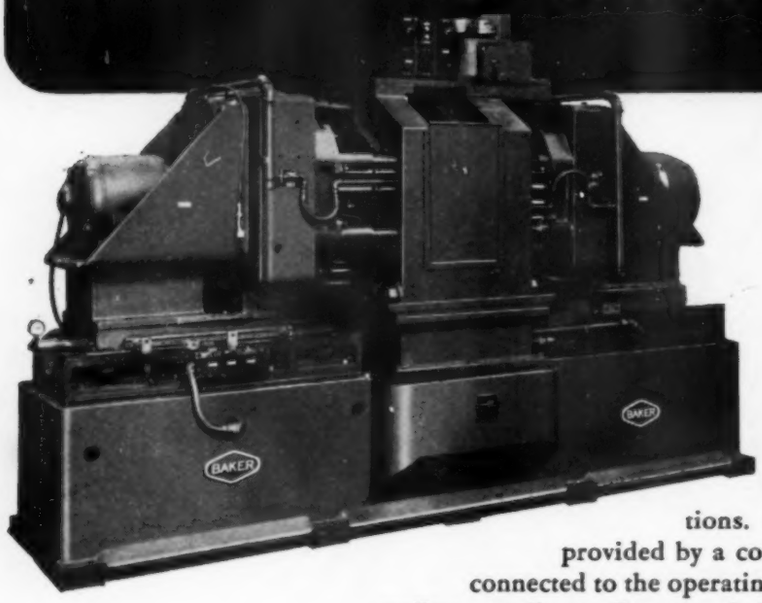
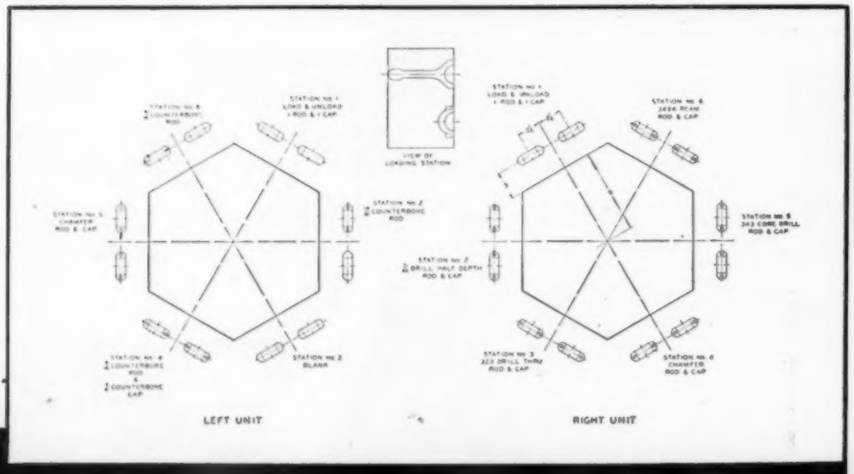
BAKER ... KEY TO Increased Productivity



TWO-WAY HIGH PRODUCTION MACHINE

High production machining of automobile connecting rods and caps is done faster on the illustrated new Baker two-way horizontal special floor-type machine. The right and left drilling units are standard model 15 x 16 hydraulic feed units that may be mounted in horizontal, vertical or angular planes with adaptability to single or multiple spindle operations. Hydraulic power for the 15 x 16 units is provided by a completely separate mobile pump sump unit connected to the operating cylinder of the machine by only two self-sealing couplings. Power unit is mounted on casters for easy exchange. For engineering data covering the 15 x 16 unit write for circular No. 69955.

Baker special high production machine with 15 x 16 units. Right unit drives a 20 spindle fixed center multiple head assembled with a self contained lubricant pump. Left unit drives a 12 spindle head. Machine is equipped with a six station automatic index trunnion arranged to clamp one automotive connecting rod and cap at each station. See illustration and diagram at right.



BAKER BROTHERS, Inc., Toledo, Ohio

DRILLING...TAPPING...KEYSEATING...CONTOUR GRINDING MACHINES

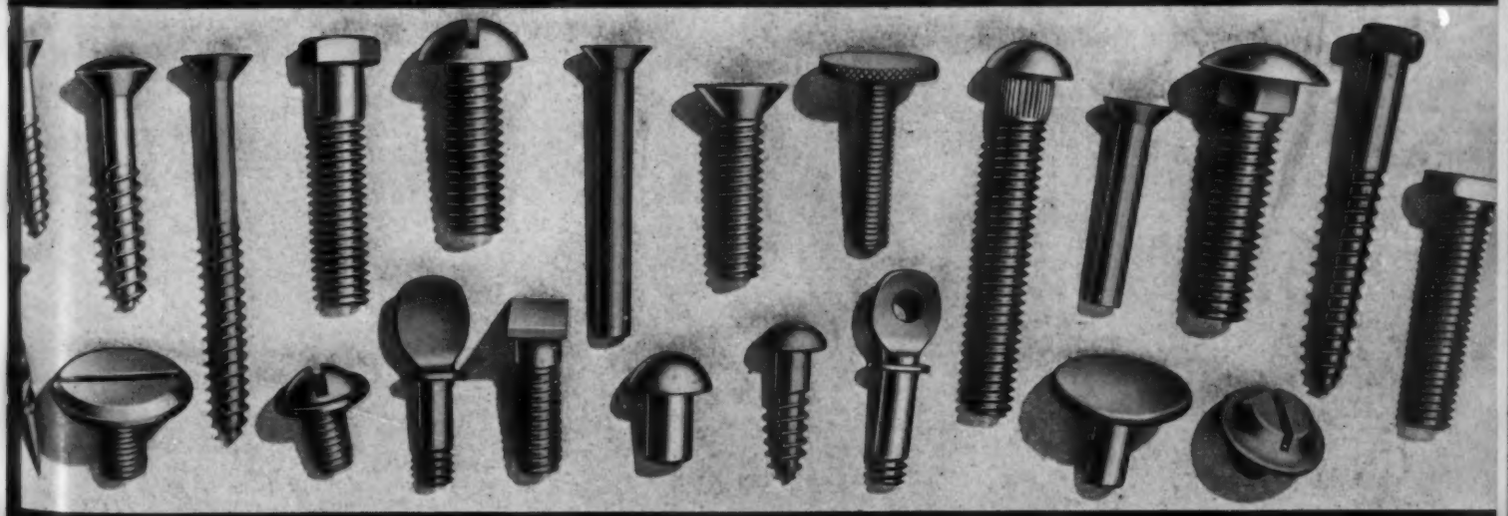
Anaconda

EXTRUDED and DRAWN COLD HEADING WIRE

YELLOW BRASS · CARTRIDGE BRASS · COMMERCIAL BRONZE
RED BRASS · PHOSPHOR BRONZE · NICKEL SILVER · EVERDUR

Next page, please...

WIRE FOR COLD HEADED SCREWS, BOLTS, RIVETS, STUDS, ETC.



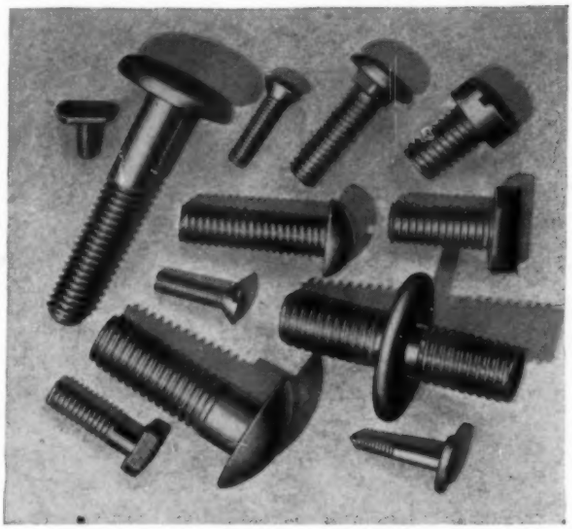
THE AMERICAN BRASS COMPANY · WATERBURY 88, CONN.

USE A COLD HEADING WIRE

tailored to your products ...for use on your machines

THERE'S a big difference—both in quality and unit cost—when the wire is exactly right for the job! For many years The American Brass Company has been supplying leading manufacturers with Anaconda Cold Heading Wire especially adapted to particular problems of tooling, rate of production and desired properties of the finished product.

Tell us what you make, and whether the part is drawn, headed, roll or cut threaded, formed, spun, peened, upset, stamped, knurled, machined, soldered, brazed, welded or riveted. We'll make sure you get cold heading wire tailored to the job —with carefully controlled temper to meet your requirements for hardness, strength, stiffness and workability.



Typical machine screws made of Everdur.

Anaconda Brass Extruded Heading Wire is widely used for the production of wood screws.

These rivets were made from Anaconda Alloys listed at the right.

ANACONDA COLD HEADING ALLOYS

Yellow Brass Extruded Heading Wire—A standard yellow brass wire, extruded and cold drawn, for easy cold heading of screws, bolts, rivets, studs and accessories. Used for builder's hardware, electrical fixtures and equipment, radio, mechanical assemblies. Most widely used high brass screw wire.

Cartridge Brass (70%) Extruded Heading Wire—Another excellent extruded and cold drawn high brass wire, particularly adaptable for fabrication of fastenings with intricate shapes and contours.

Commercial Bronze Heading Wire—This alloy has good hot and excellent cold working qualities and is used for the fabrication of fastenings where appearance is an important factor.

Red Brass Heading Wire—The hot and cold working qualities of this alloy are similar to Commercial Bronze. It is used extensively where a color match with architectural bronze is desired.

Phosphor Bronze (Grade A)—Furnished in wire for special-purpose fastenings where superior strength or fatigue-resistant qualities are essential.

18% Nickel Silver Wire—A white metal possessing exceptional resistance to corrosion and ease of fabrication. Nickel Silver Wire can be obtained in all grades from 5% to 30% Nickel.

Everdur* 1015 Wire—This copper-silicon alloy combines unusual strength and toughness with high resistance to corrosion. Its uses include boat fastenings, marine hardware, poleline hardware, electrical parts, switch gear, etc. Working properties of this alloy permit the somewhat unusual operation of cold extruding in heading machines.

*Reg. U. S. Pat. Off. 48120

ANACONDA

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WITH SPECIAL FORMED TOP JAWS

An economical and efficient tooling set-up to help reduce costs. Complete, detailed engineering and application data together with description and listing of all types of Chucks, Rotating Air Cylinders, Stationary Air Cylinders and Accessories will be found in Catalog PO62 . . . write for it now.

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HIGH SPEED STEELS

NO OTHER HIGH SPEED STEELS Give you ALL these advantages

1 MO-MAX was the first of the modern molybdenum high speed steels. Since 1933 it has been widely used in all types of cutting tools.

2 MO-MAX has superior cutting qualities.

3 The machinability of MO-MAX is unexcelled.

4 MO-MAX is economical. Its specific gravity is about 8% less than that of 18% tungsten steel.

5 MO-MAX is available in a standardized composition; also in cobalt and high vanadium varieties for special high speed steel requirements.

LEARN ALL THE FACTS! *Send for your copy of the MO-MAX Handbook, seventh edition. Get the full story about this remarkable steel, including easy-to-follow instructions on heat treating.*

Buyer's Guide to Brands of MO-MAX

"LMW"	Allegheny Ludlum Steel Corp.
"MOHICAN"	Atlas Steels, Ltd.
"BETHLEHEM HM"	Bethlehem Steel Co.
"MO-CUT"	Braeburn Alloy Steel Corp.
"STAR MAX"	Carpenter Steel Co.
"MOLITE M-1"	Columbia Tool Steel Co.
"REX T-MO"	Crucible Steel Co. of America
"DI-MOL"	Henry Disston & Sons, Inc.
"HI-MO"	Firth-Sterling Steel Co.
"REX T-MO"	Halcomb Steel Co.
"MOGUL"	Jessop Steel Co.
"TATMO"	Latrobe Electric Steel Co.
"MIDMAX"	The Midvale Co.
"S. T. M."	Simonds Saw & Steel Co.
"MO-TUNG"	Universal-Cyclops Steel Corp.
"8-N-2"	Vanadium-Alloys Steel Co.
"VUL-MO"	Vulcan Crucible Steel Co.

THE CLEVELAND TWIST DRILL CO. 1242 EAST 49th STREET CLEVELAND 14, OHIO

An Important Announcement From The Ford Motor Company

Since 1923, we have manufactured and distributed the world-famous Johansson Blocks.

We now have completed negotiations for the sale of the Johansson Gage Division of the Ford Motor Company to Brown & Sharpe Manufacturing Company of Providence, R. I. Before this transaction was completed, we gave very careful consideration to the problem of finding a company with the skill and experience that would assure continued production of Johansson Blocks to the Johansson standards of quality.

The Brown & Sharpe Manufacturing Company has 115 years of experience in the making of precision tools, and after careful study, we decided that this experience, coupled with their standing in American industry have made them the sound choice to take over the manufacture of these precision gages.

All patents, methods and machines required for making Johansson Blocks become the property of Brown & Sharpe. Machinery and special steel stocks are being moved to Providence.

Meantime we will continue to provide Johansson Blocks from available finished stock here at Ford until Brown & Sharpe are in operation and ready to supply them.

Johansson GAGE BLOCKS

FORD MOTOR COMPANY

BAUMBACH *The* DIE SET AUTHORITY

All Baumbach Die Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing Leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver. Write for Catalog.

E. A. BAUMBACH MFG. CO., 1804 S. Kilbourn Ave., Chicago 23, Ill.

PRESSES
FEEDS
AUTOMATIC EQUIPMENT
THE V&O Press Co.
HUDSON N. Y.

HARDNESS TESTER

The *Scleroscope* is the only hardness tester that takes in the entire range from the softest to the hardest metals without any adjustments.

MODEL D-1 DIAL TYPE
Write for Circular!

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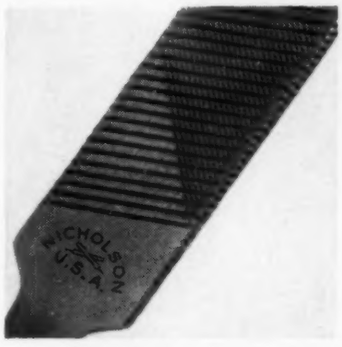
JAMAICA, NEW YORK
TELEPHONE: JAMAICA 6-4090

"KNOW YOUR FILES and CUT COSTS"

It's the cost of the workman's time that counts in filing operations. This is one of a series of advertisements on special-purpose files. Save it for shop and purchasing reference.

Subject: FILES FOR ALUMINUM

Prepared by Nicholson File Co.



"Type A" Aluminum File

Flat Bastard File

Filing Aluminum

WHY ALUMINUM REQUIRES A SPECIAL FILE. Aluminum is a soft, ductile, malleable metal and any cutting tool used on it has a tendency to build up chips before it. This is likely to dull the tool. The difficulty in filing soft aluminum with a regular purpose file is that the teeth are soon clogged unless very light pressure is used.

CONSTRUCTION OF ALUMINUM FILE. After much study and practical testing, Nicholson has produced the "Type A" Aluminum File which is specially designed for filing aluminum and aluminum alloy castings. This file has a fine overcut and a deep upcut. The fine overcut produces on the upcut a succession of small scallops which break up the filings and enable the file to clear itself of chips. The open-throat construction also tends to prevent clogging of the file. The light overcut reduces "chatter" by preventing the teeth taking too large bites.

USE OF ALUMINUM FILE. Nicholson and Black Diamond "Type A" Aluminum Files are designed to cut aluminum rapidly and without clogging, but to leave a somewhat better finish than the coarser special files for aluminum. They should be used on work where quick removal of stock is more important than finish; however, by filing with a shearing action toward the left a good finish can easily be made.

In some cases, such as with harder aluminum or aluminum alloy castings, regular Flat Bastard Files are often satisfactory; but wherever these have a tendency to clog, the special-purpose "Type A" Aluminum File should be used.

Nicholson and Black Diamond "Type A" Aluminum Files are available through your industrial supply house. They come in Flat and Half Round shapes, 6" to 14" in length, and all in one degree of coarseness.

Nicholson makes special-purpose files for Brass, Lead, Aluminum, Stainless Steel, Foundry Castings, Die Castings, Die Making, Lathe Filing, Curved and Shear Tooth Filing—and Swiss Pattern Files of all shapes and sizes.

FREE BOOK—*"FILE FILOSOPHY."*

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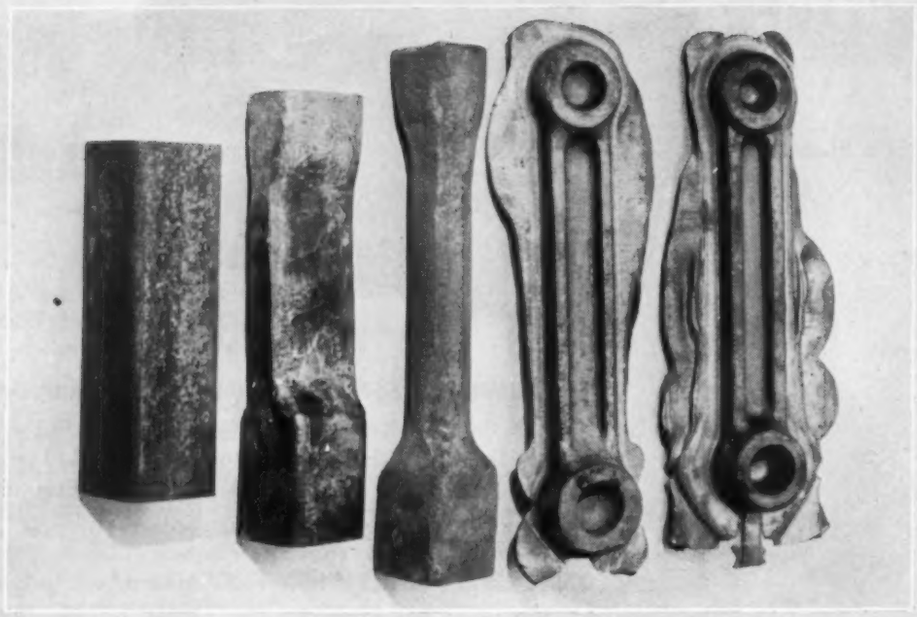
(In Canada, Port Hope, Ont.)

NICHOLSON FILES FOR EVERY PURPOSE



MAXIROLLING REDUCES MATERIAL COSTS 25%!

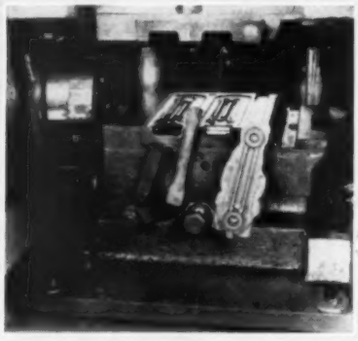
It is estimated that Maxirolling realizes a stock savings of more than 25% over previous methods used to forge the aircraft engine articulating rod forging illustrated above!

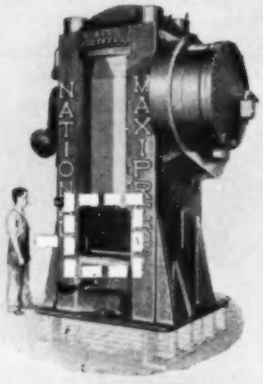
Seen at the extreme left is the 6⅛" long by 2" round-cornered square stock which the Maxiroll preforms in two passes, after which a rough forge followed by a finishing blow in the Maxipres completes the forging, shown at extreme right.

The Maxiroll, the newly developed reducing mechanism, is located in a side window of the press, is press-driven and occupies no useful die space.

Additional advantages of Maxirolling are reduced scrap loss, increased die life, reduced die washing, faster production rate and a less skilled operator.

Let us help you investigate the application of Maxirolling to your products.





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TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF
MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET AND WIRE NAIL MACHINERY

New York Detroit Chicago

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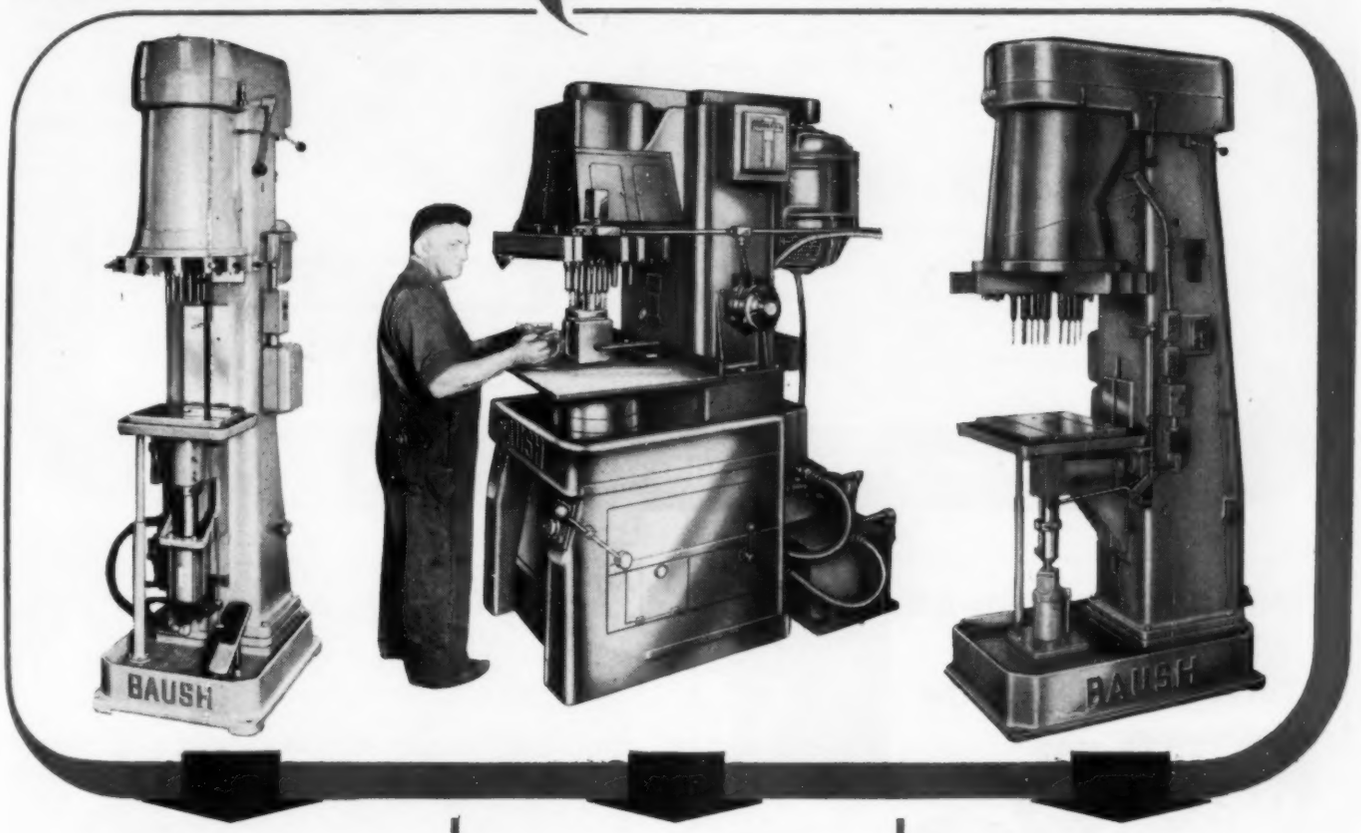
MULTI-SPINDLE MACHINE TOOLS

THIS "AD" MEANS $$$ to you . . . Check it as thoroughly as you would a bank statement.

Today's markets require low-cost high-speed quality production. To this end the Baush Machine Tools illustrated have been designed. These light-duty multi-spindle machines are versatile in use . . . compact in size . . . sturdily built and specifically designed for maximum production with minimum investment. While prices are low . . . quality is high.

Precision engineered by Baush, these machine tools meet the demands of every production line — whether small or large — for economy and competitive production.



MODEL 46

Size of head . . . . . 8" Round
Number of spindles . 12
Max. stroke of feed . 4"
Height of Machine . 5' 10"
Floor space . . . . . 25" x 19"
Drilling capacity
in cast iron . . . . . (12) 1/8" dia. drills
Net weight . . . . . 1100 pounds

MODEL TF

Size of head . . . . . 10" x 15" or 14" round
Max. Number of Spindles . . . (16) 1"
Max. Feed Stroke . . 6"
Height of Machine . 8'
Floor Space . . . . . 34" x 36"
Drilling capacity
in cast iron . . . . . (16) 7/16" dia. drills
Weight . . . . . 4500 pounds

MODEL 47

Size of head . . . . . 15" Round
Number of spindles . 16
Max. Feed Stroke . . 6"
Height of Machine . 7' 9-1/4"
Floor Space . . . . . 28" x 40-1/2"
Drilling capacity
in cast iron . . . . . (16) 3/16" dia. drills
Net weight . . . . . 3000 pounds

Check Specifications. Write, wire, or phone us today . . . our engineers will be pleased to help you

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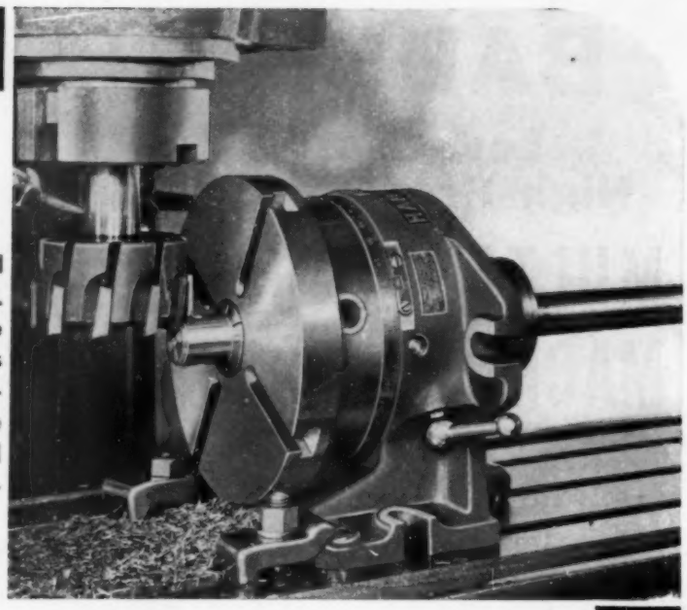
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

SUPER-SPACER

FOR

MILLING

The uses of the Super-Spacer in horizontal and vertical milling operations are unlimited. Here the Super-Spacer, mounted with a face plate and draw-in collet combination, shows its adaptability for milling bar stock. Investigate your present milling methods and see if your shop can't profit by the speed and accuracy of the Super-Spacer. For complete details write Dept. S2.



SPECIAL MACHINERY

HARTFORD SPECIAL is equipped to build from prints almost any type of special machinery, parts or operations. Our facilities give your shop an added capacity. Bulletin E-200 gives complete list of our Machinery Equipment and capabilities. We'd be glad to send you one.

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THE HARTFORD SPECIAL MACHINERY CO. HARTFORD 5, CONN.

THIS DIAL Controls All FACE GRINDING Table Speeds on the ROGERS NT-20

Table speed changes from 10 to 70 ft. per min. controlled by a single finger tip dial,—*anytime while the machine is running.* Provides correct grinding speed for iron and steel sections . . . and holds it even when the load is increased. No starting shock —reversals are automatic, vibrationless, quiet. The only medium-duty grinder in its price range built for fast, steady face grinding production. Write for bulletin No. 320.

20" cylinder grinding wheel.

•

10 H. P. Motor.

•

Capacity to 12" high, 10" wide, 72" long.

SAMUEL C. ROGERS & CO.

197 Dutton Ave. Buffalo 11, N. Y.

Replace those off-size "war babies" with modern SHELDON Lathes

SHELDON TRBS-56
11¼" Swing Lathe

TU-1248P
13⅛" Swing Lathe

L-44
10⅛" Swing Lathe

5 years ago you took what you could get and did a job with it. Today you can get better lathes that will lower costs while increasing output.

With every increase in labor and other costs, the losses from operating "war babies" and antiquated "clunkers" increases. With modern SHELDON Precision Lathes you can do more accurate work, and do it faster, easier in less floor space and with lower power cost.

With "Zero Precision" Tapered Roller bearings a run-out accuracy of .000015, extra collet capacity and modern 4-speed V-belt drives, these moderate priced lathes will work to the closest tolerances and hold their accuracy under continuous, full speed, full capacity operation.

SHELDON MACHINE CO., Inc.

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MONTREAL MA 5346
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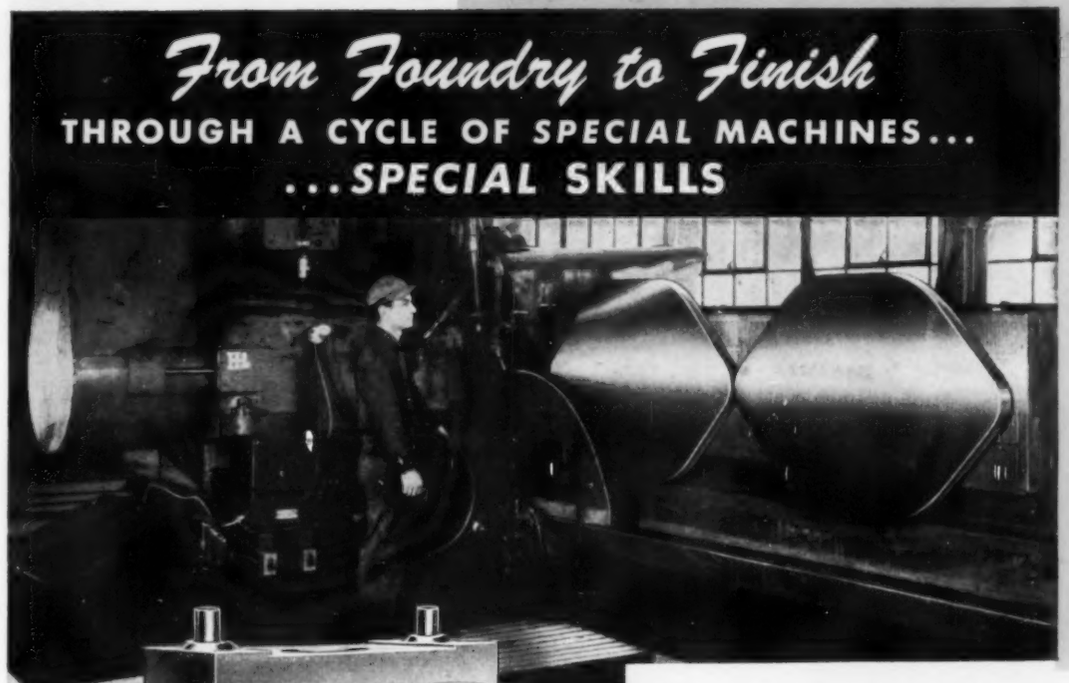
From Foundry to Finish

THROUGH A CYCLE OF *SPECIAL* MACHINES...
...*SPECIAL* SKILLS



Magnetic chuck on Hanchett grinder holds two die beds (38"x58" each) for vertical surface grinding to a satin finish.

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There's no need to "roll your own" when Producto can supply you with Specials of the highest quality in the shortest time.

Through long experience, we have developed custom-built machinery, specifically geared to handle close tolerance work on all types of die-sets from small, intricate designs to giants of several tons.

"Near Neighbor Service" from 26 cities gives you speed and convenience . . . provides personal discussion of your requirements through telephones listed herewith.

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12PD48

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YOUNGSTOWN Cold-finished Bars are ideal for high-speed screw machine products, small shafting and many other items. The uniformity of the high quality steel used in their manufacture results in excellent machinability.

Youngstown Cold-finished Bars are produced in a wide range of sizes—straight lengths or coils. We should like to consult with you on your cold-finished bar requirements. Call our District Sales office and a representative will call upon you promptly. We will make every effort to meet your needs to your complete satisfaction.

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Manufacturers of Carbon, Alloy and Yoloy Steel

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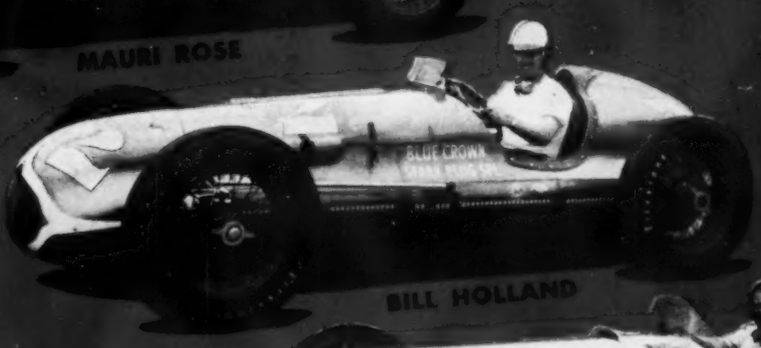
1st

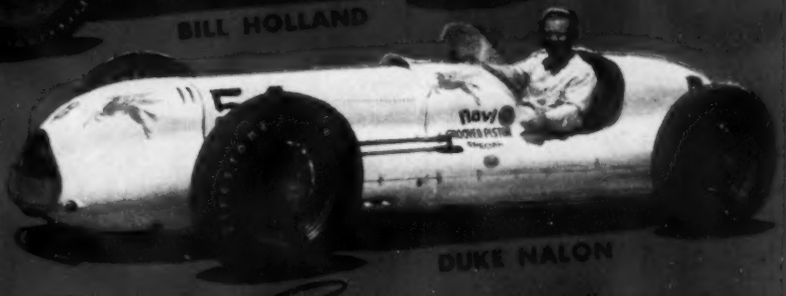
MAURI ROSE

2nd



BILL HOLLAND

3rd



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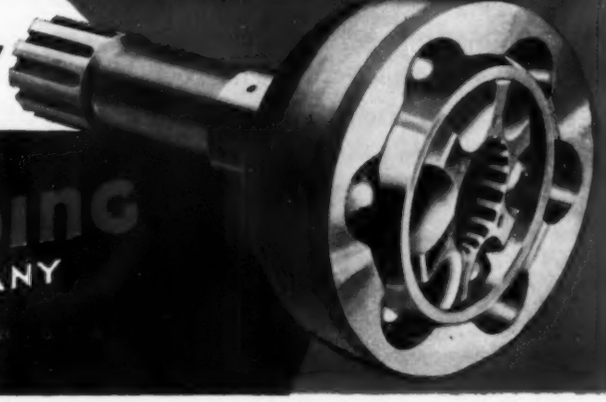
In 1947, first, second and fourth cars were equipped with RZEPPA Universal Joints

***All three winners*—first, second and third—broke *all* Speedway records for the grueling 500-mile race, with average speeds only a trifle less than two miles per minute.**

Rzeppa universal joints are as dependable in industry as they are in automobile and speed boat racing. Their high torque capacity, *their freedom from destructive vibration* and their precision manufacture make them the choice of designers and manufacturers who want the best in performance, long life and freedom from service.

Literature, describing the many sizes and types now available will be mailed on request.



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one look one blade

all cutting jobs DONE FASTER with the new Victor wall chart

With this new Victor Wall Chart near the tool crib or in your machine shop, it takes only one look to find the one blade that's best for the given job. And, once you use it, all jobs can be performed much faster, with fewer rejects and broken blades.

Besides showing you how to match blades to materials, this attractively printed, 17 x 22 inch Victor Wall Chart gives you valuable information on the care and use of the blades themselves—tips that are very valuable in cutting blade costs.

It's all yours, too, absolutely FREE. Simply write on your letterhead to your Victor supplier or to the address below. *The supply is limited.*

This is but one of the many helps offered by Victor supplier. He is the right man to see for the right blade. He has the complete Victor line—a blade for every job a hack saw or a band saw can do. No matter what you cut in the way of metals, plastics, or other non-metallics—there's a Victor blade to cut it faster, cleaner, and last longer. See your Victor supplier for the best blades.

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Makers of Hand and Power Hack Saw Blades, Frames and Band Saw Blades

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Iridite is a non-electrolytic chemical process, used and approved by leading manufacturers. If your products use zinc die cast parts, write today for information on how Iridite can help you make a better, more salable product.

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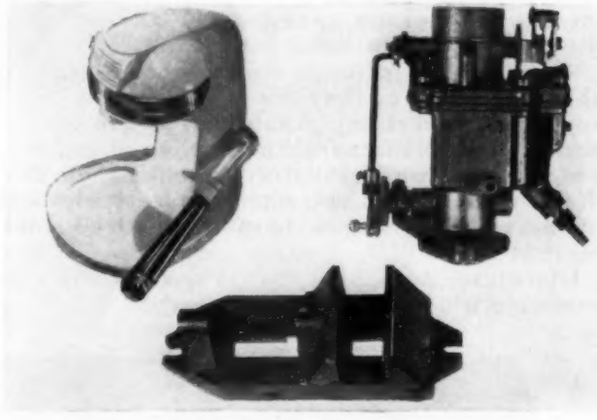

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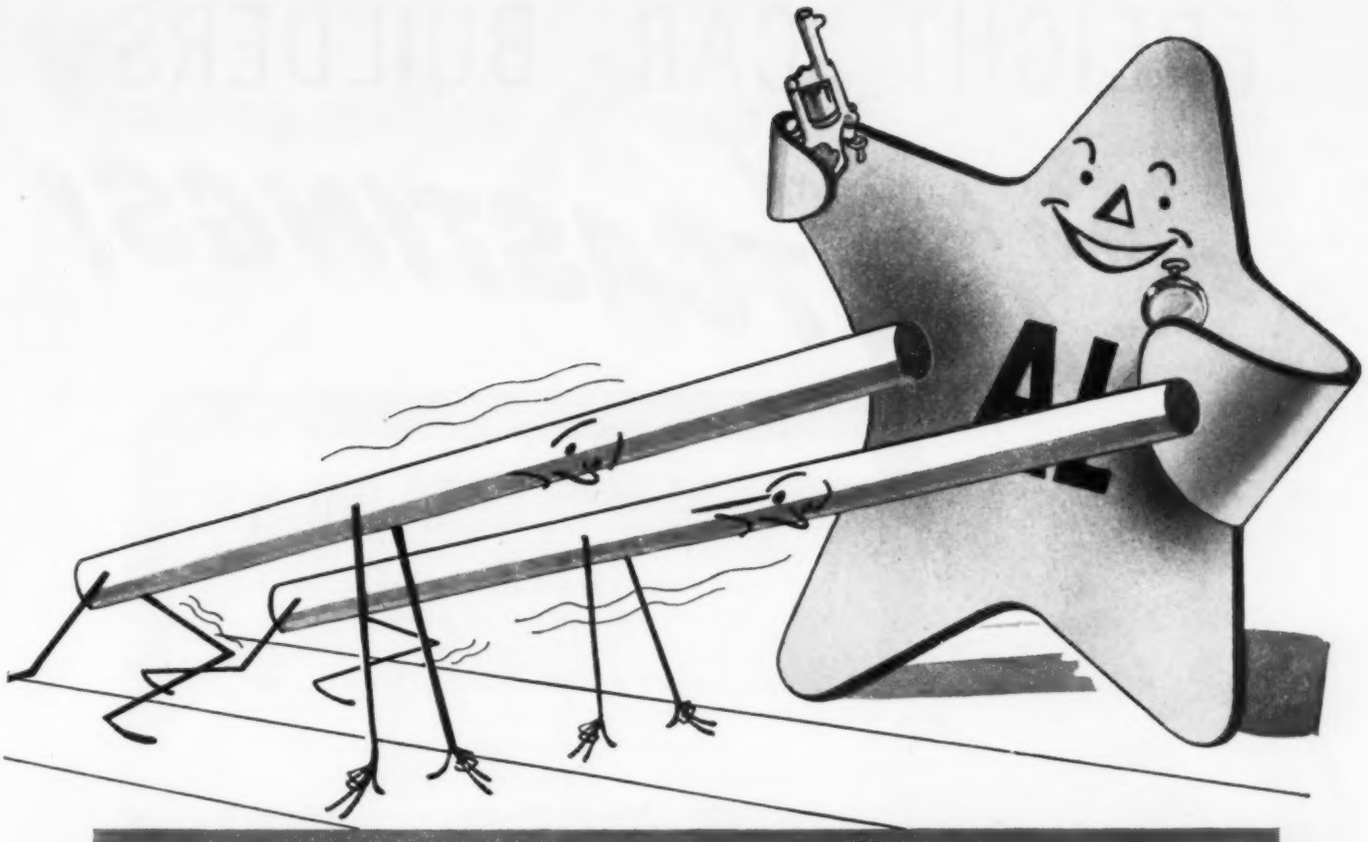

Why start a *PRODUCTION RACE* with Drill Rod that's already over-worked?

Get *your* copy of our new book on

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Every production man can use this 32-page book to advantage—it gives a complete and clear comparison of the characteristics and best uses of all types of Cutting Materials. *Write for your copy.*

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Now you can get High Speed Drill Rod in the smaller sizes that is *unspent,* full of stamina—capable of better performance and longer cutting life than ever before. Allegheny Ludlum has perfected a new special process of *hot-drawing* these small sizes—avoiding the frequent anneals necessary with repeated cold-draws down to size, accompanied by severe strains, and with each reheating taking some of the life out of the steel.

The result is High Speed Drill Rod that can show you maximum hardness, and something extra in toughness when hardened and tempered—a fine-grained steel with small, evenly distributed carbides that produce maximum cutting ability and tool life.

This product is available to you in the *grade* you're accustomed to using, too—all grades and types of High Speed Steels, as well as high carbon-high chrome Die Steel types. • Why not secure its advantages right away—get in touch with your local A-L representative or distributor.

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Fine Tool Steels Since 1854 W&D 1777

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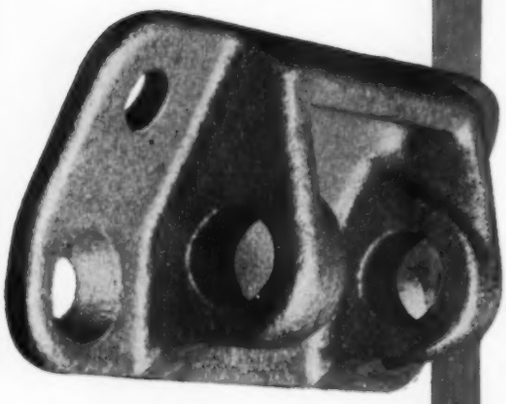

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The hinge butt is an excellent example of the importance of a cast steel unit used by the railroads. Made in one piece . . . all sections are knit properly to one another and the job is complete within itself. Nothing to put together—nothing to come apart! No jigs or fixtures are necessary and no drilling or prefabrication is required to waste time. The metal is placed where necessary to gain strength and reduce weight.

Regardless of your line of manufacture, Unitcast can recommend and produce dependable cast steel units that will do *your* job *right!*

For a definite step toward cost reduction, talk to our consultants about UNITCASTINGS.

Write or call today!

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ALLOY AND CARBON ELECTRIC STEEL CASTINGS

You can make parts like these on automatics—

AT A CUTTING OIL COST OF ONLY 7¢ A GALLON !

What! A cutting fluid for only 7 cents a gallon?

Yes, sir: Antisep All-Purpose Base, the best coolant you can buy for any money, giving top performance from every angle—finish, tool life, operators' satisfaction, etc.

It's a cutting base combining all the necessary film strength, lubricity and anti-welding properties you can get in any oil. You mix it with WATER, and use the solution at 15-to-1 to 30-to-1 in automatic screw machines. Here are its proven advantages:

1. **Economy—water costs less than oil.**
2. **Safety—no danger to machine bearings, for water solutions have high film strength.**
3. **Cool work—pieces not too hot for operators or inspectors to handle No blueing.**
4. **Antiseptic treatment provides freedom from rancidity; kind to every skin it touches.**

This base, high in fatty oil, will handle 90% or more of all your machining or drawing operations. Get the whole story from E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia 33, Pa.

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All-purpose Base

Mac-it ALLOY STEEL SCREWS

Insure smoother operation at POSITIVE levels with STRIPPER BOLTS!

Mac-it Stripper Bolts or Shoulder Screws have greater holding power where you want it in die-assemblies. They are also used as stud bolts and in various machine assemblies. Easily tightened with Mac-it Key. Will not work loose. *All* Mac-it screws are heat-treated and accurately made with die-cut threads. Whatever your needs, let the *complete* Mac-it line serve you. Sold through recognized distributors from coast to coast and in Canada.

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ALMOND DRILL CHUCKS

Maximum Gripping Power with Extreme Accuracy and Long Life
Write for Catalog
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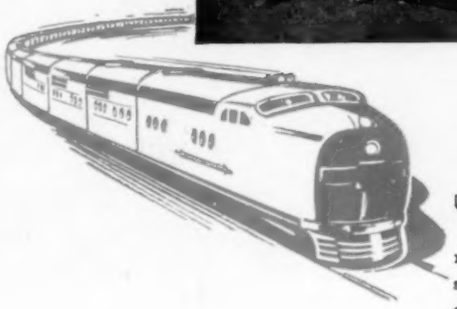

It's All a Matter of Balance

THESE challenge the maker of forgings . . . The demands of manufacture . . . actual performance of machines in service . . . analysis of materials . . . combining of all vital metallurgical properties without over emphasis on any single one. Correct design, construction, weight, controlability in machines to produce the toughest *forgings* . . . These challenge the maker of *hammers*. Experienced hammergangs produce *forgings* equal to the metallurgists' top recommendations, equal to the skilled craftsmanship of every man *only* when hammers are built for the job to be done. Erie Steam Hammers, Board Drop Hammers, Single and Double Frame Forging Hammers, and Pneumatic Hammers are products of over 50 years' experience in producing the Hammer You Need To Make Perfect Forgings. All parts in Erie Hammers subject to impact . . . anvils, frames, upper works, are steel. Write for bulletins giving full description of Erie Hammers.

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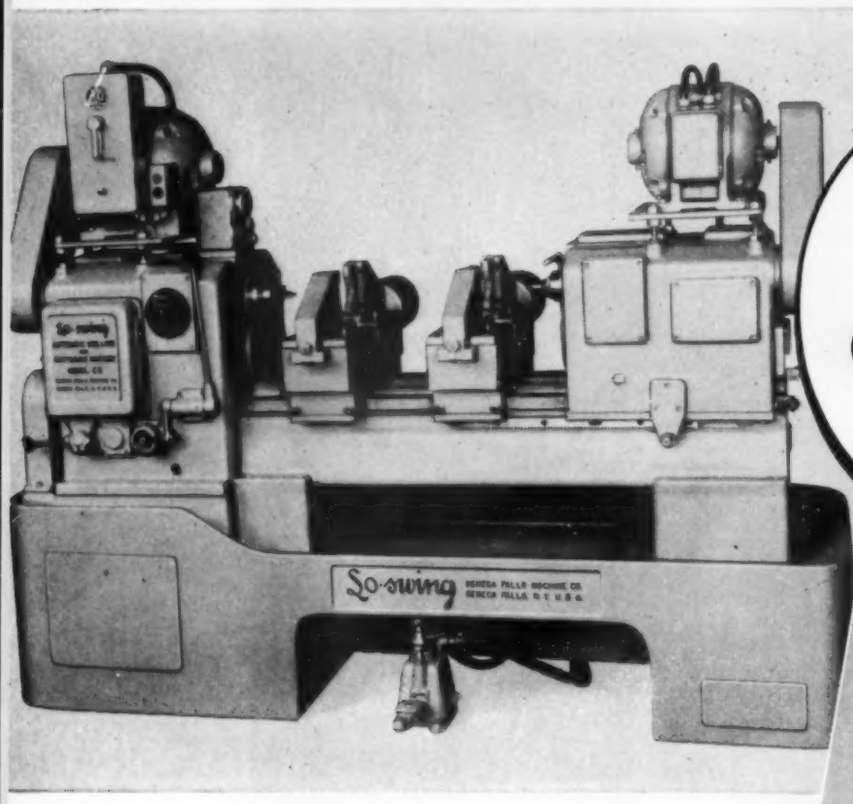
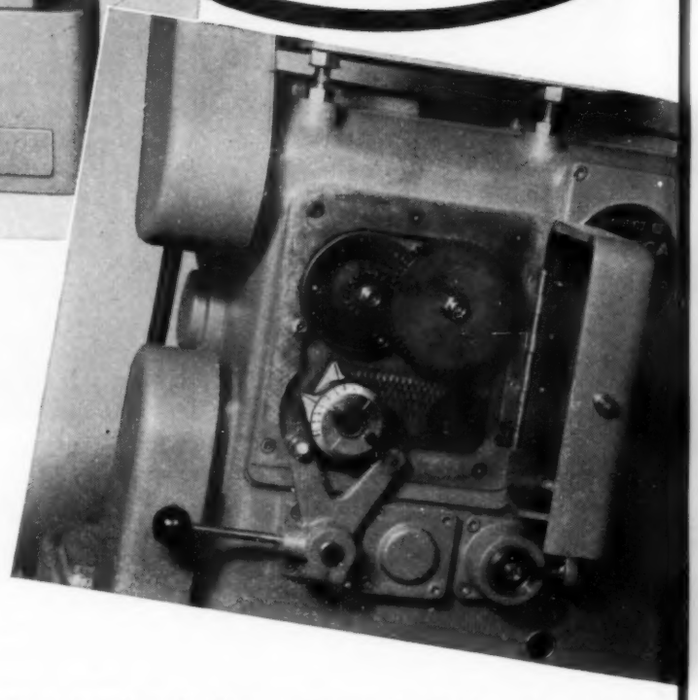
ERIE BUILDS *Dependable* HAMMERS

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK



REDUCE YOUR CENTERING COSTS



WITH A *Lo-swing* AUTOMATIC DRILLING and CENTERING MACHINE

● The Lo-swing Model "CS" has demonstrated a marked ability to cut costs on both mass production and short-run jobs. Both speeds and feeds can be quickly changed and automatic cycle time held to a strict minimum due to its exclusive HIGH SPEED, ADJUSTABLE RAPID TRAVERSE MECHANISM.

TWO INDEPENDENT, MOTOR-DRIVEN HEADS provide the correct spindle speeds for EACH head when different size drills or combination countersinks are used. Cam operated drilling spindles assure POSITIVE ACTION...cams will operate for any depth of cut within machine's capacity and DO NOT REQUIRE CHANGING. The Rapid Traverse Mechanism for both heads is controlled by cams which are PRESET TO A GRADUATED DIAL...much more efficient than the "set and try" method.

Standard, quick-acting, equalizing, air-operated vises are available and may be arranged to operate singly or in pairs. Ample distance from the bed to the spindle provides sufficient room for special work-holding fixtures which are available as extra equipment. ELECTRIC MOTORS ARE THE STANDARD FOOT MOUNTING TYPE and may be furnished in sizes from 1 to 3 H.P.

Model "CS" is available in four standard sizes, 18″, 42″, 66″ and 90″ between drills. Write for full information on this new cost-cutting equipment.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

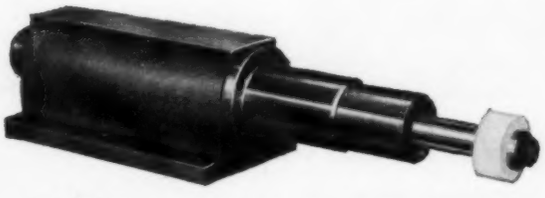
PRODUCTION COSTS ARE LOWER WITH *Lo-swing*

POPE

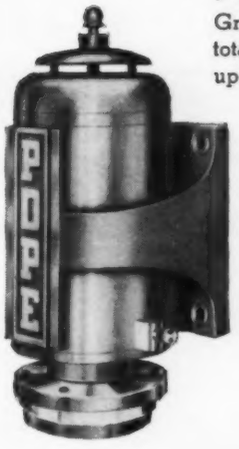
GRINDER SPINDLES AT A GLANCE

P-32T Pope Sealed Package Spindle for 6" x 18" Surface Grinders, with a full 1 HP, 3450 RPM totally enclosed motor; for use with grinding wheels up to 8" O. D., ¾" face, 1¼" hole.

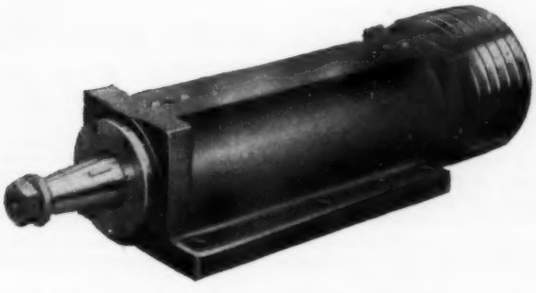
P-1004 Pope Direct Motorized Tool Grinder Spindle with 1 HP, 3450 RPM totally enclosed motor; for grinding wheels up to 8" O. D., ¾" face, 1¼" hole.



P-2463 Pope Heavy Duty Vee Belt Driven Cartridge Type Spindle in mounting bracket; for grinding wheels up to 4" O. D. at 6000 RPM, 2" face with 1" hole.



P-2500 Pope Heavy Duty Motorized Spindles in a variety of sizes from ¼ HP to 20 HP and from 900 to 3600 RPM.



P-666 Pope Heavy Duty Vee Belt Driven Grinding Machine Wheel Head Spindle; for grinding wheels up to 28" O. D., 1½" face, 8" hole at 750 RPM. Maximum speed 4000 RPM.

Here is a representative showing of POPE Precision Grinding Spindles. Others are available in a great variety of sizes and styles. Each assures:

1. Constant Production of Uniformly Good Finished Surfaces.
2. Cool Operation At High Speeds Over Long Periods.
3. Sealed Lubrication Performance — no oiling or greasing, nothing to renew, replace or adjust throughout the entire life of the bearings.

NO. 52

POPE

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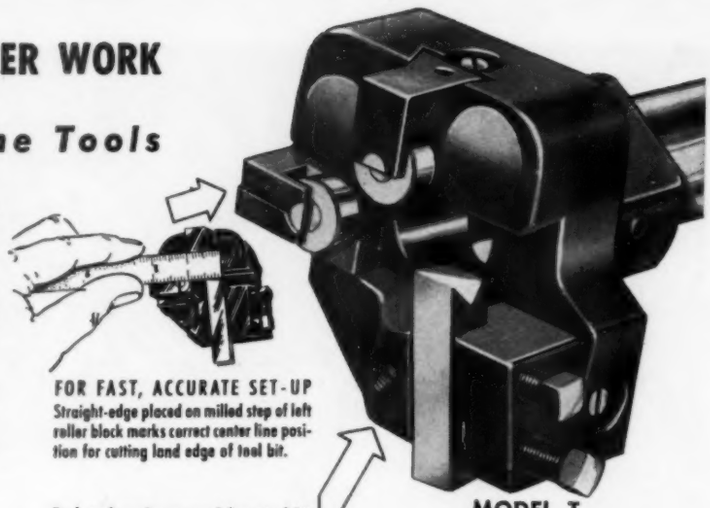

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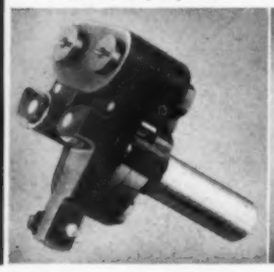
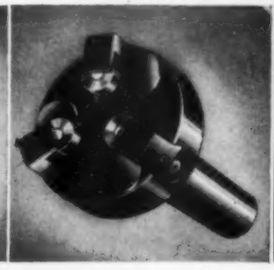


Model DRH Adjustable Drill and Reamer Holder. In Three Sizes

Model C Burnishing Tool Made in Three Sizes, 00, 0 & 2



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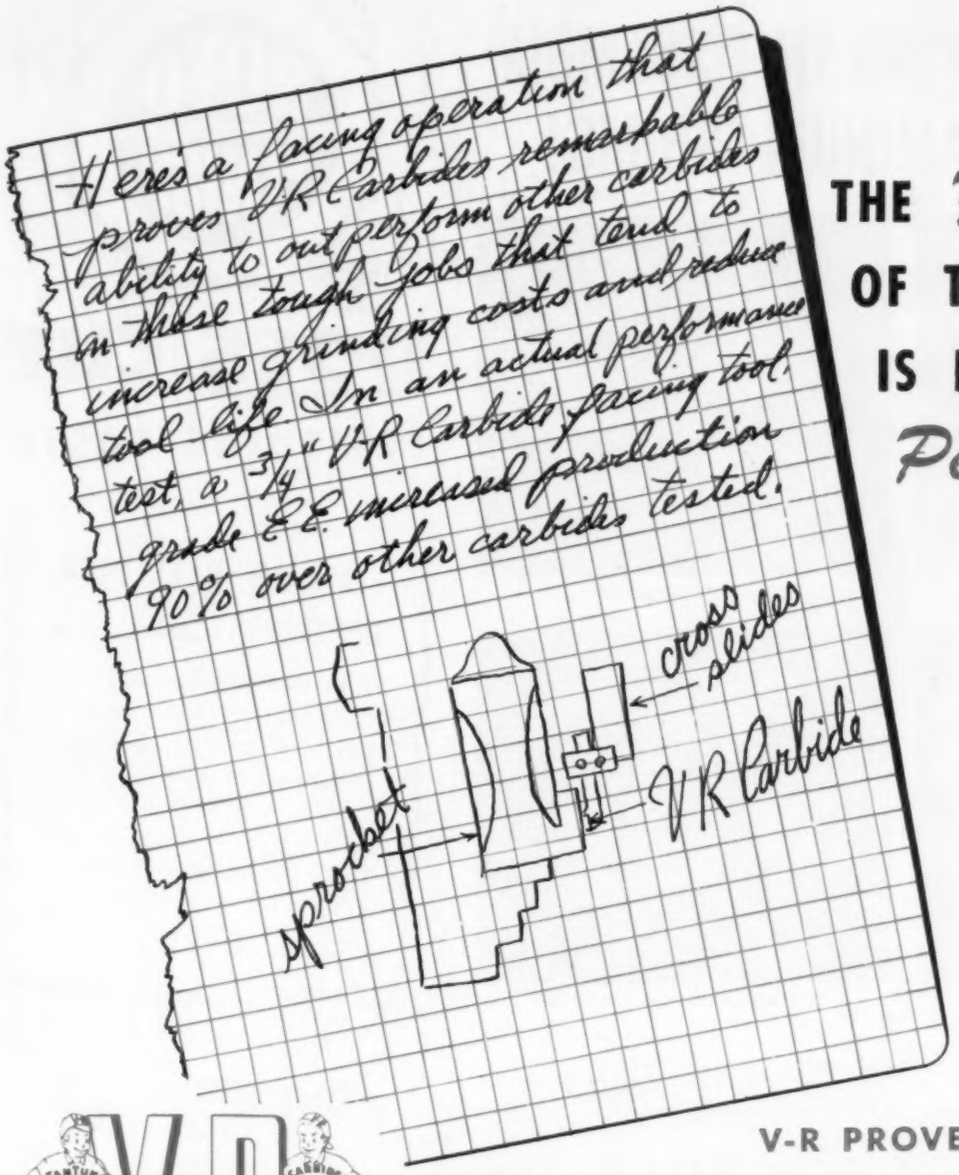
Here's a facing operation that proves V-R Carbides remarkable ability to outperform other carbides on these tough jobs that tend to increase grinding costs and reduce tool life. In an actual performance test, a 3/4" V-R Carbide facing tool, grade EE increased production 90% over other carbides tested.
cross slides
sprocket
V-R Carbide

THE *Proof* OF THE CARBIDE IS IN THE *Performance*

V-R

V-R PROVEN PERFORMANCE

MACHINE: Potter & Johnson Automatic, 6 years old
MATERIAL: Tough, Scaly Steel Castings
OPERATION: Facing sprockets. 1/8" to 1/4" depth of cut from 7 3/4" O.D. to 4 1/8" I.D.
TOOLS: 3/4" Carbide Tipped Facing Tool

The Proof:

	V-R Carbide, Grade EE	Carbide "A"	Carbide "B"	Carbide "C"
S.F.M.:	194 to 116	194 to 116	194 to 116	194 to 116
Feed per Rev.:	Hand Feed	Hand Feed	Hand Feed	Hand Feed
Depth of Cut:	1/8" to 1/4"	1/8" to 1/4"	1/8" to 1/4"	1/8" to 1/4"
Pcs. per Grind:	100	8	10	9
Remarks:	V-R Carbide finished the remainder of 500 sprockets with a single tool, reground only 5 times.			

Many times the application of V-R Carbides to a particularly difficult problem is unique—the result of an unprecedented need arising from some new development in industry—and V-R Carbides provide sure, economical production. Call your nearest V-R Field Engineer today for a quick, economical solution to YOUR tool problem.

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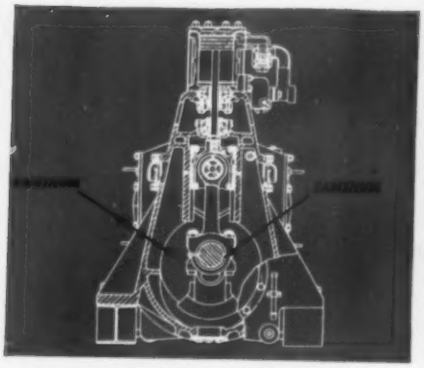

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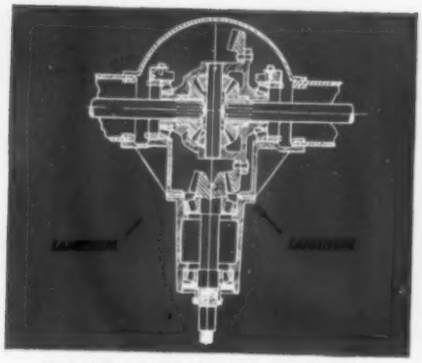
FOR SPLIT BEARINGS



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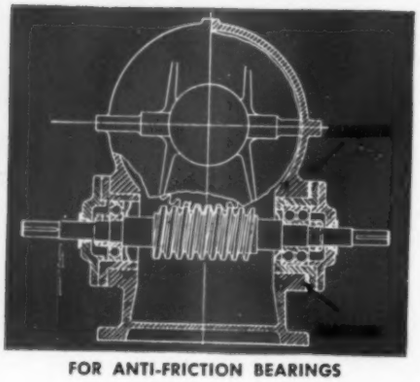

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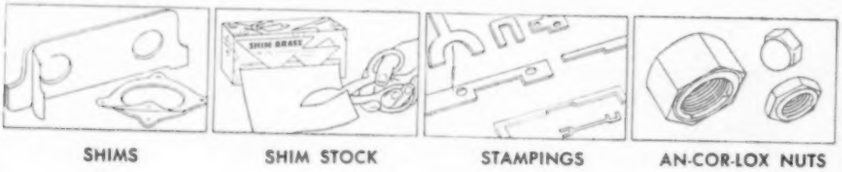

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DOES CUT FINISHING COSTS

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Unretouched illustration shows crank plate for fishing reel; above, before Roto-Finish deburring and finishing; below, after Roto-Finishing.

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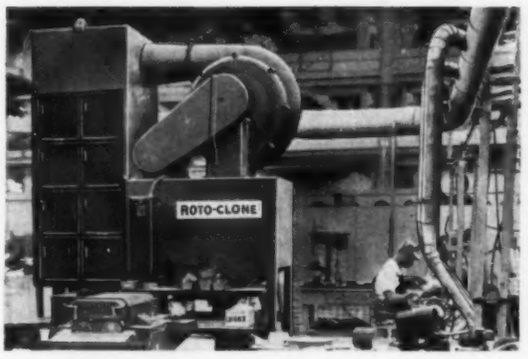
THE ENGINEERED
MECHANICAL FINISHING PROCESS

ROTO-CLONE eliminates "dust bowl" in tool crib

THERE are 28 dust-producing grinders in this open tool crib. But the workers breathe clean air and no trouble-making dust finds its way to nearby precision tools and intricate assembly operations.

The reasons—Roto-Clone* is on the job. Pictured below is a view of the Type D Roto-Clone system serving these grinders. At right you see a close-up of the Roto-Clone with viscous filter after-cleaner to permit recirculation of the cleaned air.



The Type D Roto-Clone is a dynamic precipitator combining the functions of exhauster and dust separator in one self-contained unit. Uniform air volume assures high collection efficiency under all operating conditions. It is economical to operate; can be located at or near dust source and may be installed as a central system or to serve a single operation.

When you select the Type D Roto-Clone you pick the favorite, because more grinding wheels are exhausted by this dynamic precipitator than any other make of dust collector. For complete information, call your local AAF representative or write direct to—

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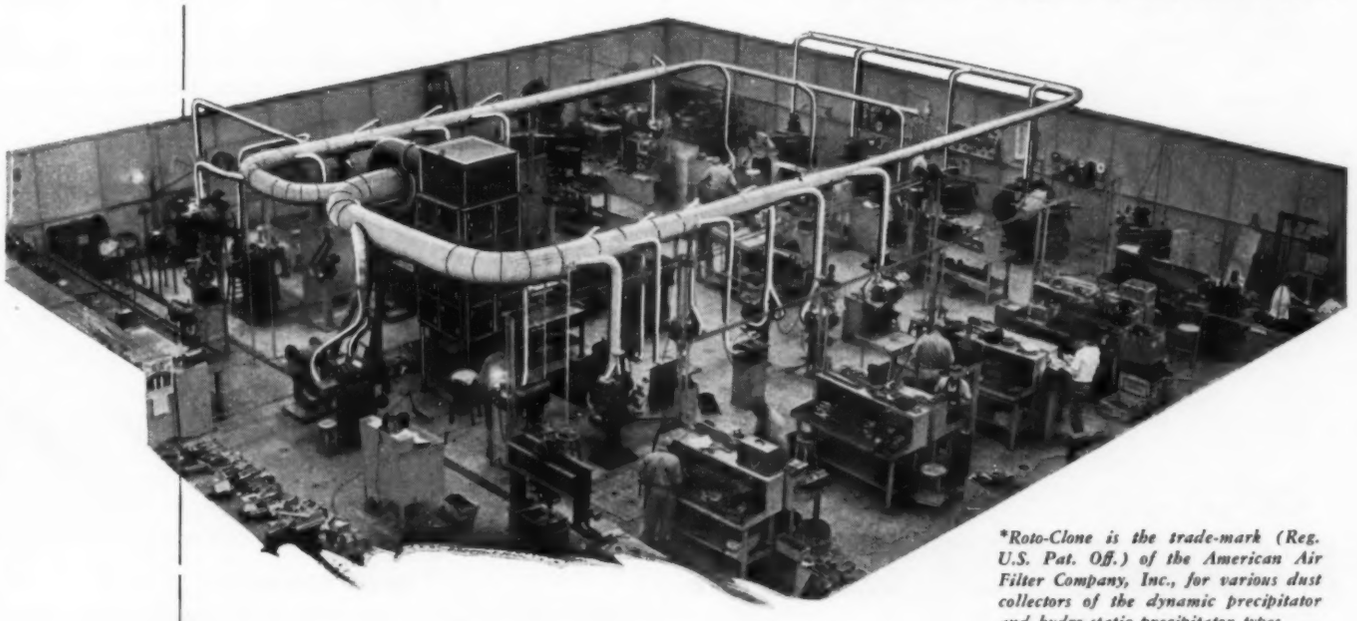

**Roto-Clone is the trade-mark (Reg. U.S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.*

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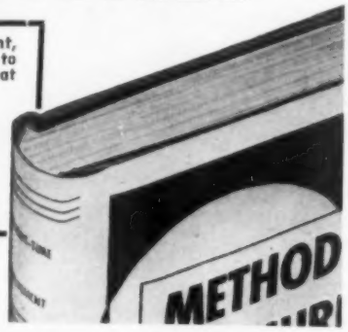
Any manufacturer, superintendent, or foreman can put this guide to work in developing standards that

- improve existing methods
- help determine effective production operations
- serve as a guide in designing products for economical output



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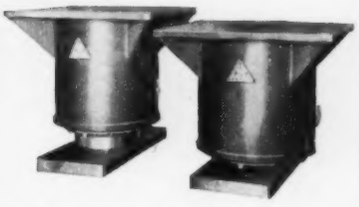

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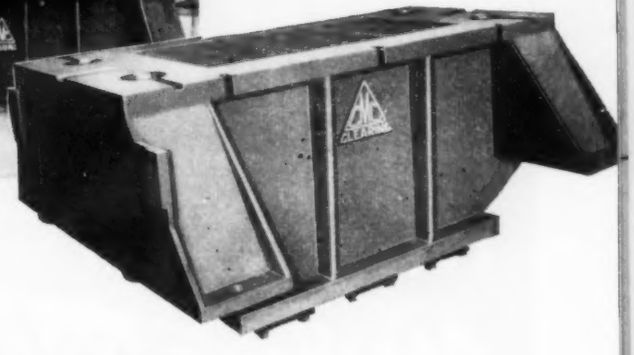

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That's because Clearing has always been a leader in developing better solutions to press problems. Welded all-steel construction to reduce deflection and prolong die life was a Clearing contribution to the industry. More extensive use of cushions, with greater versatility of control, is another. Many Clearing single-action presses, for example, are doing work for which double-action equipment would otherwise be required.

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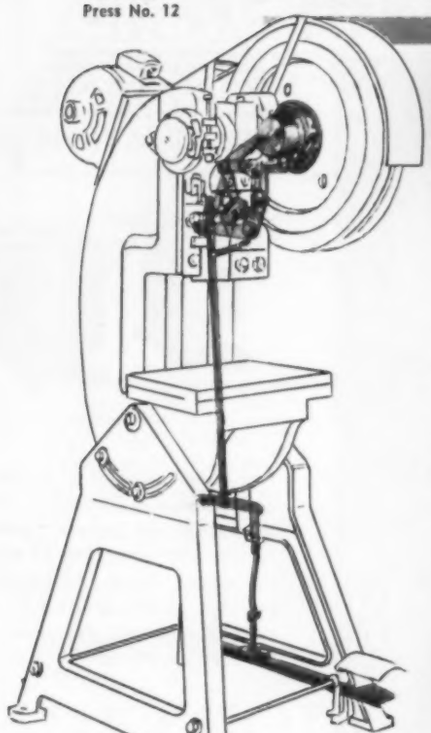
How Greater Safety Increases Press Output

PRESS-RITE
Press No. 12



PRESS-RITE Presses eliminate operator fear

The outstanding feature of the new 1948 line of PRESS-RITE Presses is the new Safety Non-Repeat Mechanism. This feature alone is sufficient reason to purchase a PRESS-RITE Press . . . because it eliminates operator fear and increases operator output two ways. In addition, it protects not only the operator but the dies and the press too!

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Other outstanding PRESS-RITE Press features include

- Automatic cam actuated brake
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- Rugged reinforced frame
- Triple ramway lubrication

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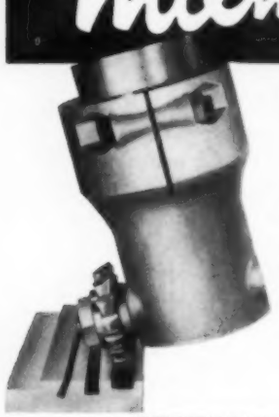

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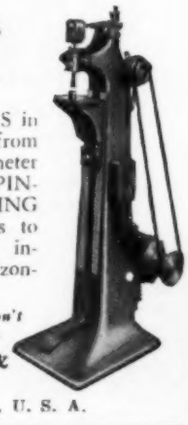

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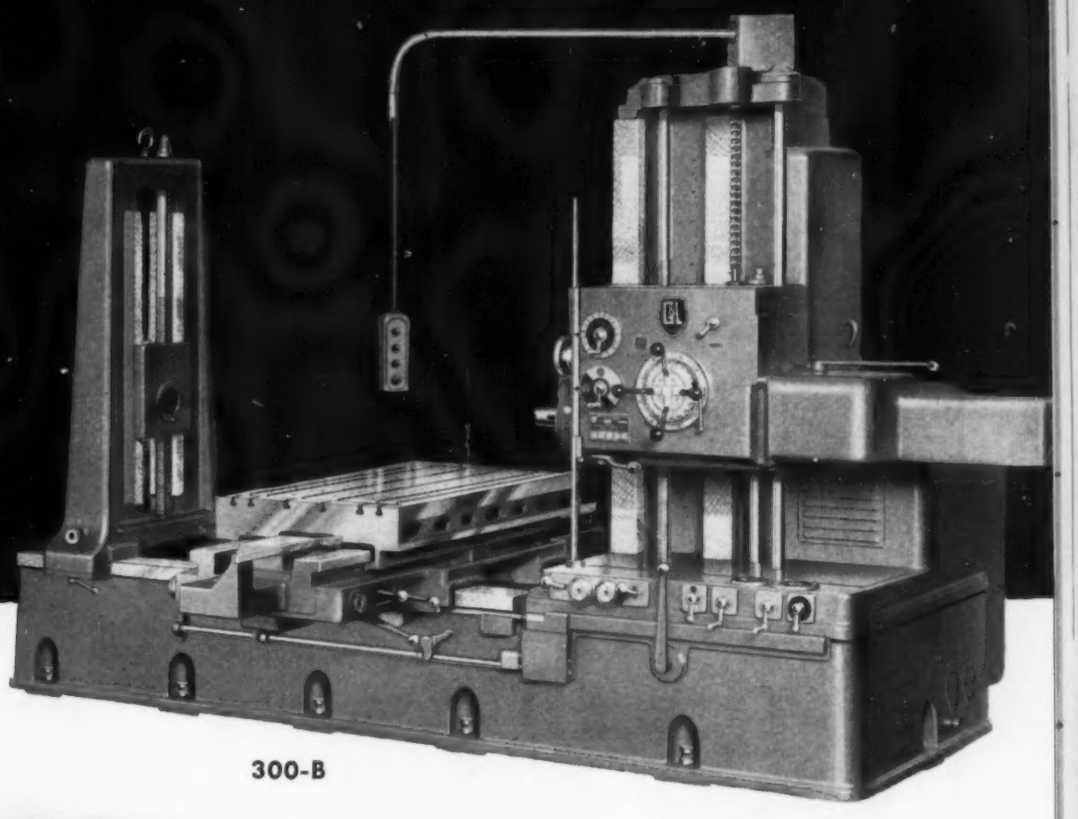
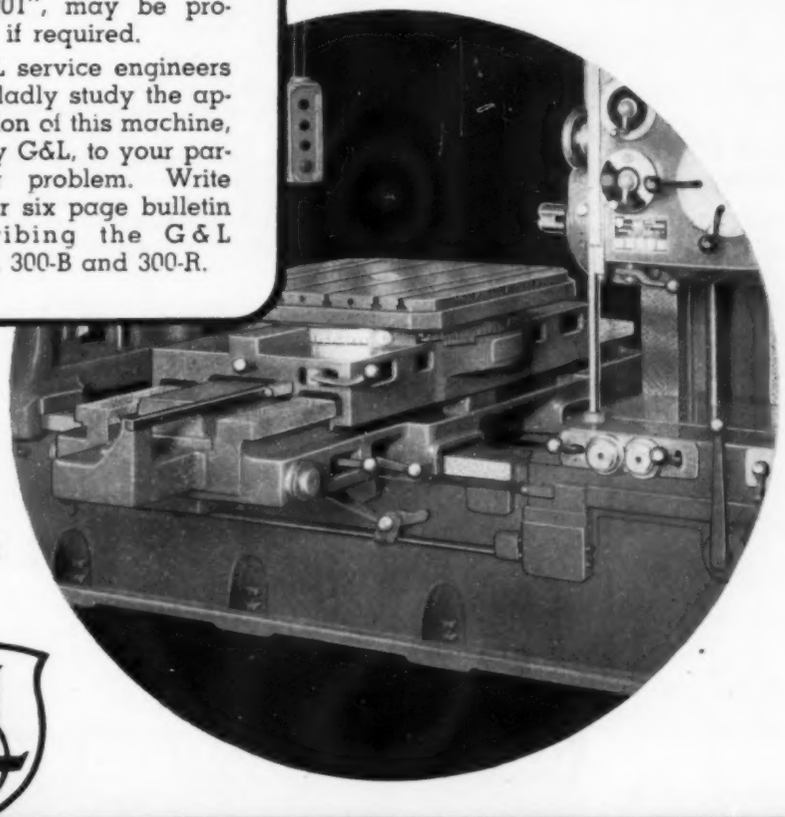
Built-in scales and verniers give readings to .001" for headstock, table and saddle movements. A simple micrometer measuring attachment reading, with the use of standard measuring rods to .0001", may be provided if required.

G&L service engineers will gladly study the application of this machine, or any G&L, to your particular problem. Write for our six page bulletin describing the G&L 300-A, 300-B and 300-R.



300-B



300-R

SPINDLE DATA

Diameter	3.000"
Longitudinal Travel	24"
Number of Speeds	36
Speed Range (RPM)	22 to 1600
Number of Feeds	18
Feed Range (Inches per Rev.)	
Between 22 and 180 RPM	.002 to .125
Between 200 and 1600 RPM	.0012 to .062

MACHINE DATA

	300-A	300-B	300-R
Working surface of Table	24"x42"	30"x48"	30"x36"
Cross Travel of Table	30"	36"	36"
Max. Saddle movement on bed with End Support in place	30"	36"	36"
Max. dist. face of Spindle Sleeve to End Support	60"	72"	72"
Headstock Travel on Column	30"	36"	33"
Number of Milling Feeds		23	
Range of Milling Feeds to Headstock, Table and Saddle in inches per minute		1/16 to 30	
Motor Recommended		10 HP - 1750 RPM (Dyn. Bal. .001" NEMA)	

G&L

GIDDINGS & LEWIS Machine Tool Company

FOND DU LAC WISCONSIN U.S.A.

WE STOCK DIAMETERS!
1/8" to 10 1/2" Round

Tubing has always been a standard product with Ward Steel Co. However, it has never had the emphasis that it has today, and will have tomorrow. A tremendous expansion in tubing inventory, coupled with increased cutting facilities and our prompt delivery service, gives testimony to our proud boast that we are really in the tubing business in a big way. Call Ward Steel on your warehouse requirements for seamless steel mechanical and welded tubing.

ALSO WE STOCK

Cold Finished Bars, Flat Wire & Strip Steel.
General catalog will be mailed on request.

WARD STEEL CO.

49 FARNSWORTH STREET BOSTON 10, MASS.
Phone Liberty 2-2770

7 FENNER STREET PROVIDENCE 8, R. I.
Phone GAspee 8573

ROTO-MATICS

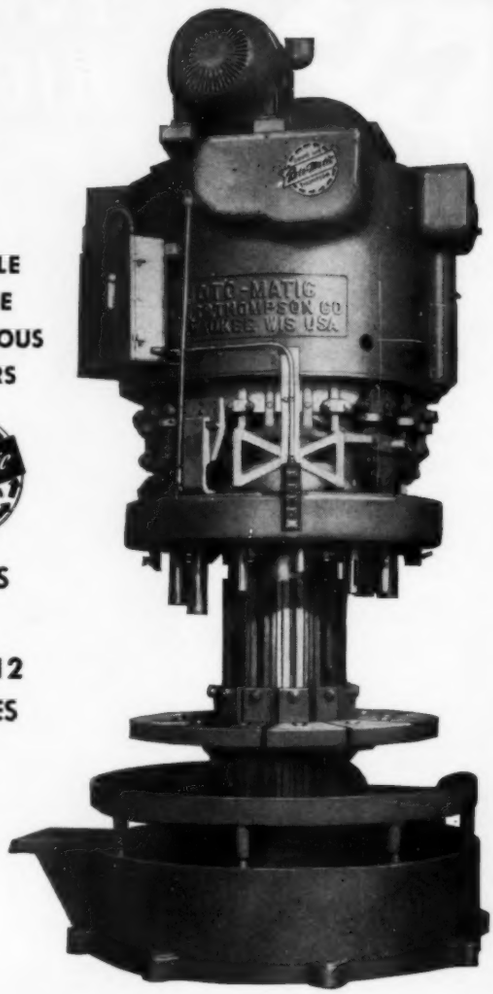
VERTICAL

MULTIPLE SPINDLE CONTINUOUS DRILLERS

DAVIS and THOMPSON Roto-Matic

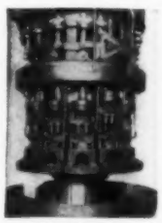
3 SIZES

6-8 OR 12 SPINDLES

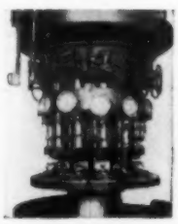


One Vertical ROTO-MATIC will equal the production of a whole battery of single spindle drillers with a proportionate reduction in labor and maintenance costs.

Where production demands fall below the capacity of the machine, on a single part, interchangeable fixtures can be designed for a variety of jobs. Where two operations are required on a single piece, requiring the same feeds and speeds, spindles can be arranged to give you the proper ratio of production.



2 SPINDLE DRILL HEADS



BALANCING OPERATION

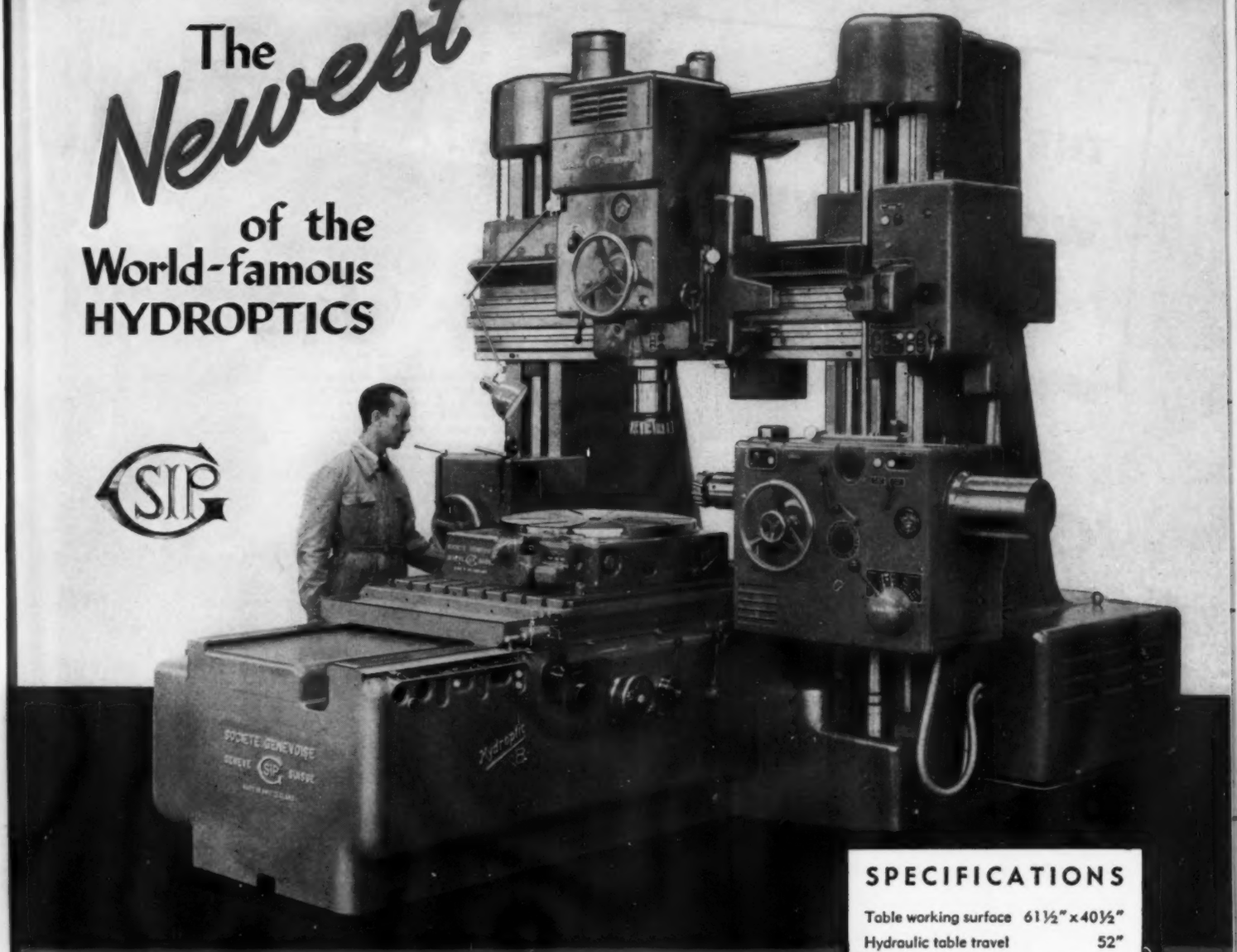
AUTOMATIC CLAMPING

Engineering skill and thirty years of development have given us the necessary background to tool up these machines for the maximum in efficiency and accuracy of work, whether it be drilling, milling, boring, reaming, spot facing or chamfering.

WRITE FOR BULLETIN 101.

DAVIS and THOMPSON CO.
MANUFACTURERS OF *Machine Tools*
MILWAUKEE 14, WISCONSIN

The *Newest* of the World-famous HYDROPTICS



SPECIFICATIONS

Table working surface	61½" x 40½"
Hydraulic table travel	52"
Infinitely variable hydraulic table feeds	
Transverse travel of vertical spindle head	40"
Vertical travel of horizontal spindle head	29"
Drilling capacity in cast iron	2⅜"
Boring capacity	10"
Guaranteed accuracy for all settings of work table and spindle head	0.0002"

HYDROPTIC—8
JIG BORING AND MILLING MACHINE

WITH its large table capacity and its powerful vertical and horizontal spindles, the new Hydroptic—8 is the most versatile Jig Boring and Milling Machine in the complete SIP line. The optical measuring system, consisting of standard scales read directly by built-in microscopes, is free from wear and mechanical stress and permits settings to be made in three coordinates to 0.0002". This exclusive SIP feature, combined with the exceptional ruggedness and precision of SIP construction throughout, makes the Hydroptic—8 a high capacity machine on which work can be laid out, machined and checked for accuracy in one set-up.

COSA CORPORATION

624 Chrysler Building New York 17, New York

Representatives for SIP in United States and Canada

THE WORK GLOVE WITH 7 LIVES

JOMACS OUTWEAR ORDINARY WORK GLOVES UP TO 7 TO 1 . . . SHOP RECORDS PROVE IT !

JOMAC work gloves not only *outwear* ordinary gloves—they *outperform* them, too. They can be washed or dry cleaned repeatedly, and used over and over again. They have unusual flexibility, which permits complete hand freedom and assures a quick, firm grip every time.

All these advantages stem from the remarkable JOMAC fabric. It's a tough, loop-finished cloth honeycombed with hundreds of air-cell "cushions" —each one held securely in place by a hidden lock-stitch.

For full details, write C. WALKER JONES Co., 6139 North Lambert St., Philadelphia 38, Pa. Plants in Philadelphia, Pa., Detroit, Mich., and Warsaw, Ind.

Foreign Representatives: Gillespie & Co. of New York, Inc., 96 Wall St., New York 5, N. Y.

"SHAKE HANDS WITH SAFETY"

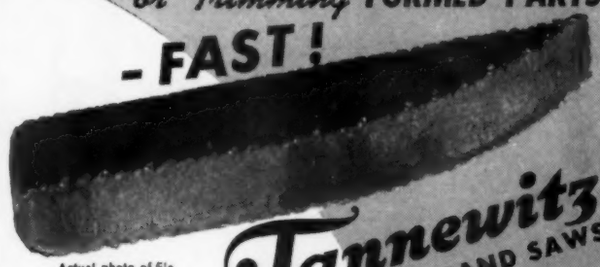
JOMAC INDUSTRIAL GLOVES

THREE TYPES OF JOMAC GLOVES

REGULAR INDUSTRIAL TYPE • HEAT- AND FLAME-RESISTING

SAFETY GAUNTLET-CUFFS

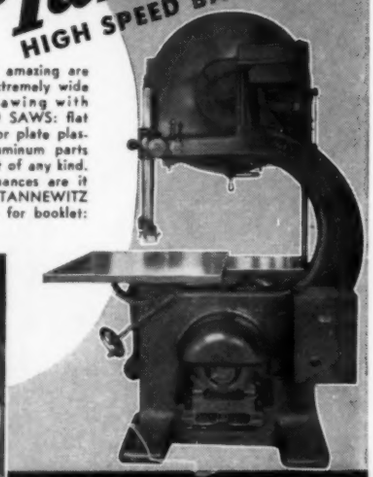
for Sawing METAL *as* HARD *as a* FILE *or Trimming* FORMED PARTS - FAST!



Actual photo of file friction sawn on Tannewitz High Speed Band Saw.

Tannewitz HIGH SPEED BAND SAWS

Cost reductions that are downright amazing are effected in the cutting of an extremely wide variety of materials by friction sawing with TANNEWITZ HIGH SPEED BAND SAWS: flat sheets, hardened or soft steels, armor plate plastics, and many others. Formed aluminum parts can be trimmed without using a rest of any kind. Whatever your cutting problem, chances are it can be done faster and better with TANNEWITZ HIGH SPEED BAND SAWS. Write for booklet: "FRICTION SAWING."



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GRAND RAPIDS 4, MICHIGAN

For HIGH PRECISION

DEPENDABLE HARDNESS TESTING

• In the field of precision hardness testing, there can be no substitute for absolutely dependable accuracy. Such accuracy is assured in the "TUKON" Tester—developed by WILSON, who have devoted more than 25 years exclusively to making fine hardness testing equipment. Two types—microhardness tester, combination microhardness and macrohardness tester. For testing fine wire, small precision parts, thin metal, superficially hardened surfaces, jewels, plastics, glass, etc. Also for research work.

TUKON TESTER for KNOOP and 136° PYRAMID HARDNESS NUMBERS

Write for descriptive Bulletin TK-48. Also DH-7, which gives experiences of actual users of the equipment.

Also makers of the "ROCKWELL" Hardness Tester

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as easy as signing your name!

Renewing the solid silver contacts in a Federal NOARK Motor Starter takes no time at all! No need for tools of any kind! Simply press one end of the contact down, and it slides out of its groove without effort. Slide in a new contact to finish the job. (And, once it's in it stays in — vibration can't loosen it out!)

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- Frictionless SOLENOID ACTION
- Instant COIL REPLACEMENT

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Federal NOARK Motor Starters

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HALF

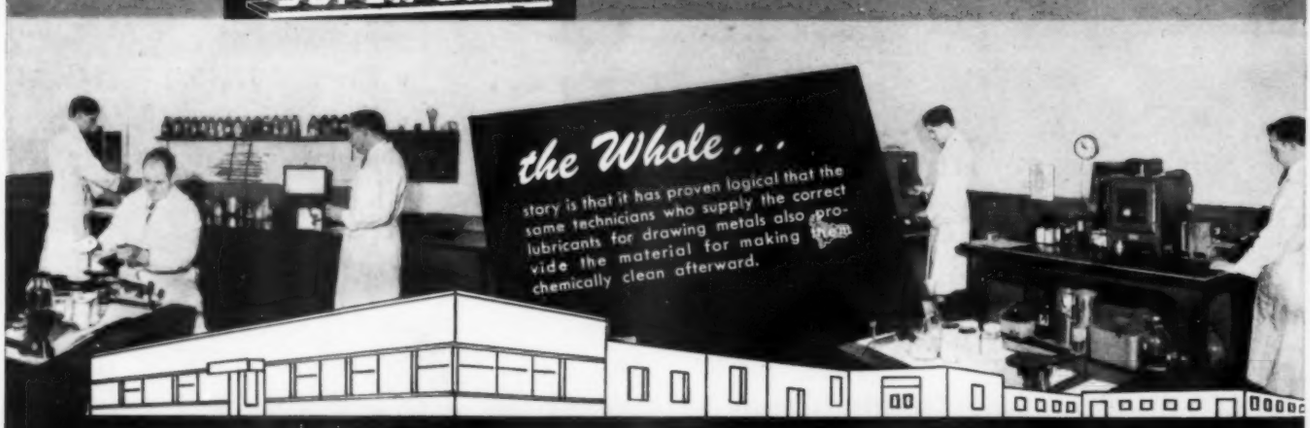
p-H control

Half of this message has to do with NORTHWEST products and processes for chemically cleaning ferrous and non-ferrous metals preparatory to plating, vitreous enameling, painting, etc., each problem involving a specific programing of one or more of the thirty-five standard NORTHWEST Cleaning Compounds including Electrolytic, Immersion, Solvent, Spray, and Water Wash types . . . the "Lo-Hi" pH process of chemically cleaning metals, preparatory to plating, porcelain enameling, etc., makes practical a control that management can plan on in these departments regardless of the type of metal or soil . . .

the other HALF

SUPER-DRAW

is concerned with metal forming lubricants developed for ferrous and non-ferrous metals in both pigmented and non-pigmented form . . . SUPERDRAW products are specifically compounded for: 1. Brass and Brass Alloys, 2. Cold Rolled Steel, Enameling Iron, Stainless Steel and Aluminum, 3. Alloys of Steel, Aluminum and Copper . . . SUPERDRAW compounds will handle light, medium, and heavy operations . . . may be applied by brush, roller, spray, or dipping . . . A request on your letterhead will bring a technician to consult you on your drawing and cleaning problems . . .


the Whole . . .
story is that it has proven logical that the same technicians who supply the correct lubricants for drawing metals also provide the material for making them chemically clean afterward.

LO HI pH

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pioneers in pH cleaning control—serving you since '32

FREE LITERATURE

(Not good after November 1, 1948)

New Catalogs, Booklets, Bulletins

MACHINES AND ATTACHMENTS

1 SURFACE GRINDER—The Blanchard Machine Co., Cambridge, Mass. 42-page booklet illustrates and describes operation of grinder, including types of wheels, methods of loading, procedure for surfacing and techniques for various materials.

2 SECOND OPERATION MACHINE—Hardinge Bros., Inc., Elmira, N. Y. 20-page bulletin DSM 59 catalogs features of high-speed, precision, second-operation machine, including photographs, drawings and text. Attachments and set-ups are illustrated and described.

3 HYDRAULIC CYLINDRICAL GRINDERS—Landis Tool Co., Waynboro, Pa. 21-page catalog F-48 illustrates three plain grinders and one hydraulic roll grinder with specifications and descriptions of extra equipment.

4 HYDRAULIC PRESSES—The Hydraulic Press Mfg. Co., Mount Gilead, Ohio. 6-page bulletin 4801 describes 20-ton-capacity laboratory press, with illustrations and specifications. Sample test setups are illustrated.

5 FINISHING MACHINES — The Sturgis Products Co., Sturgis, Mich. 14-page manual illustrates and describes Roto-Finish mechanical deburring and finishing, polishing and grinding. The manual contains descriptions and operating information on the machine.

6 SHAPING-ENGRAVING MACHINE—The Monarch Machine Tool Co., Sidney, Ohio. 6-page bulletin No. 2502 describes lathes that handle intricate shapes and designs and will form an inside sharp corner. Applications in the glass, plastics and rubber industries are noted.

7 DIAMOND GRINDERS—The Bridgeport Diamond Machine Co., Stratford, Conn. Catalog details large and small machine parts produced on grinders.

8 POWER PRESSES—Johnson Machine and Press Corp., Elkhart, Ind. 22-page catalog gives specifications and pictures of five inclinable power presses, with capacities from 16 to 56 tons. Details of bearings and tripping devices are included.

9 THREAD MILLER—Edward Blake Co., 437 Cherry St., W. Newton, Mass. 6-page bulletin No. 248 includes information on Waltham thread-milling machines for small parts and several new attachments and fixtures.

10 PLATING EQUIPMENT — The Meaker Co., Chicago, Ill. 36-page booklet No. 148 presents pictures, drawings and information on plating and processing equipment. Fully automatic machines, chain transfer units, variable speed plating machines, pickling machines and special processers are described. Data sheets of plating zinc, copper, tin and other materials are included.

11 DRILL PRESS—South Bend Lathe Works, South Bend, Ind. 6-page catalog No. 400 describes 14-in. drillpress with multi-speed attachment and motors.

12 MILLING MACHINES—The Atlas Press Co., Kalamazoo, Mich. 10-page booklet describes actual set-up of Atlas machines: millers, drillpresses, lathes and special attachments.

13 SHAPERS—Sales Service Machine Tool Co., St. Paul, Minn. 4-page folder describes 8-in.-stroke shaper and gives specifications.

14 PUNCH PRESSES—L & J Press Corp., Elkhart, Ind. 8-page catalog describes presses, both back-geared and plain-flywheel types from 5-ton to 79-ton capacity.

15 PRESSES—The Federal Press Co., Elkhart, Ind. Booklet presents drawings and descriptions of dial feed, standard and trimming presses. Specifications and press sizes are added.

TOOLS AND ACCESSORIES

16 HOLLOW MILLS—Carl Wirth & Son, Inc., Rochester, N. Y. 8-page booklet illustrates and describes three types of Kutmore hollow mills and resharpening fixture.

17 COUNTING SCALE—The Yale & Towne Mfg. Co., Philadelphia, Pa. 6 three-color bulletins totalling 68 pages cover a new line of dial scales. Counting scales, bench scales, portable platform scales, dormant platform scales, crane scales and weigh-can installations are discussed. Descriptions including illustrations and specifications are included. The bound manual is available as a unit, or each of the six bulletins is available separately.

18 SAW SHARPENING EQUIPMENT—E. C. Atkins & Co., Indianapolis, Ind. 60-page booklet describes filing-room equipment, including swage shapers, swage dies, saw sets, gages and miscellaneous equipment. The manual also includes information and instructions on the care and sharpening of saws.

19 MICROMETER GAGES—The B. C. Ames Co., Waltham, Mass. 4-page catalog No. 57 illustrates dial indicators and other dial measuring instruments, including comparators.

20 CARBIDE MILLS — Severance Tool Industries Inc., Saginaw, Mich. 4-page folder, Bulletin 16-W, presents pictures and information on milling quills of various sizes and shapes. Deburring cutters and chatterless tools are also described.

21 TOOL LIFTER—The Deca Co., Great Neck, N. Y. 4-page folder describes four types of tool lifters for shapers and planers. The product is Diener electric automatic tool-lifter.

22 TOOLMAKER MICROSCOPE—The George Scherr Co. Inc., New York, N. Y. 4-page folder describes the Wilder Toolmaker Microscope for checking threads, angles, tapers, bevel and many other measurements in the toolroom.

23 COLLET—Bales Collet Mfg. Co., Cleveland, Ohio. 14-page booklet, Catalog No. 48, announces drilled felt holes with felt inserted. Information on attaching collets to standard machines is also given.

Example

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HEAT-TREATING AND WELDING

24 ELECTRODES—Page Steel & Wire Div., American Chain and Cable Co. Inc., Monessen, Pa. Booklet DH 45 describes manganese, manganese-nickel, and high-carbon, shielded-arc electrodes.

25 FLUX RECOVERY EQUIPMENT—The Invincible Vacuum Cleaner Mfg. Co., Dover, Ohio. 6-page folder gives detailed information on equipment for submerged-arc welding, including features of design, models available and typical installations.

26 OIL STANDBY EQUIPMENT—Surface Combustion Corp., Toledo, Ohio. 8-page booklet describes equipment for burning oil during gas curtailment.

27 FURNACES—Surface Combustion Corp., Toledo, Ohio. 4-page bulletin No. SC-140 describes batch- and continuous-type, radiant-tube-heated malleableizing furnaces and presents performance data.

28 WELDERS—The Progressive Welder Co., Detroit, Mich. 4-page bulletin No. 702 describes the new line of air-operated standard 30- and 50-kva. rocker-arm welders for light- and medium-duty spot welding. Data and specifications for eight models are given.

29 SALT BATHS—The Ajax Electric Co. Inc., Philadelphia, Pa. 4-page external house organ "Tips and Trends" reports experiences in the field of salt baths, heat-treating and processing.

PLANT SERVICE EQUIPMENT

30 CONVEYOR—J. W. Greer Co., Cambridge, Mass. 4-page circular describes Greer Multi-Tier production conveyors and illustrates the use of the tray.

31 FORK TRUCK—Towmotor Corp., Cleveland, Ohio. The Operator's Guide published some years ago has been revised. It includes sections on standard fork lift truck accessories and suggestions for handling material.

32 FORK TRUCK—Clark Equipment Co., Battle Creek, Mich. 4-page folder presents specifications and illustrations of gas- and electric-power loading truck for handling packaged loads and bulk materials.

33 MARKING MACHINE — Adolph Gottscho, Inc., New York, N. Y. 8-page catalog describes and illustrates 18 marking and code-dating machines used for imprinting, indenting, embossing, etching and hot stamping containers, labels and products.

34 FINISHES—Brooklyn Varnish Mfg. Co., Brooklyn, N. Y. A house organ entitled "The Coating Corner" covers case histories of coating problems.

PARTS AND MATERIALS

35 VIBRATION CONTROL—Beltran Associates, Inc., New York, N. Y. 8-page folder describes vibration absorbing material for use with pumps, compressors and machine tools, and illustrates how mounting is possible.

36 DIAMOND WHEELS — United States Diamond Wheel Co., Aurora, Ill. 4-page folder gives drawings and specifications for cup-type and straight diamond-tipped wheels, and also describes a tool grinder.

37 FLEXIBLE COUPLINGS—Ajax Flexible Coupling Co. Inc., Westfield, N. Y. 24-page catalog contains working data on flexible couplings, including standard types S and A, and shear pin, brake drum, bolt-on and detachable-hub couplings. Construction data is also given with capacity information and dimensions.

38 DIE METAL—Ampco Metal, Inc., Milwaukee, Wis. 6-page bulletin No. 96 describes aluminum-bronze die metal, grades 21 and 22, and gives examples of their use.

39 PLASTICS—Durez Plastics and Chemicals, Inc., North Tonawanda, N. Y. 16-page booklet on phenolic molding compounds, presents data on their use, methods of molding and selection of materials. Specifications of various phenolic compounds and examples of their uses are given.

40 ELECTRIC MOTORS—Allis Chalmers, Milwaukee, Wis. 12-page bulletin provides specifications for squirrel-cage induction motors and wound-rotor and direct-current motors. Gear motors and multi-speed induction motors are covered, and a selection chart is included for applying electric motors to existing installation.

41 ELECTRIC A.C. MOTORS—Electric Machinery Mfg. Co., Minneapolis, Minn. 20-page booklet No. 24 shows how electric motors are used in the food industry and includes information on the insulation of large ac. motor coils. Another 20-page booklet features speed control for boiler draft fans. Adjustable-speed magnetic drive is discussed in detail.

42 OPTICAL ILLUSIONS—The International Nickel Co., New York, N. Y. 8-page booklet presents some common and uncommon optical illusions.

43 PLASTICS—Bakelite Corp., New York, N. Y. 24-page booklet illustrates many applications of bakelite and vinylite—also giving specifications and other information on the materials. Many commercial items are illustrated.

44 PULLEY DRIVES—The Congress Drives Div., Tann Corp., Detroit, Mich. 12-page bulletin CD 200 gives specifications for grooved pulleys, variable pitch pulleys, step-cone pulleys, crown-face pulleys, and flexible couplings. Extensive V-belt charts list comparable V-belts from various manufacturers.

45 SCREWS—The Mac-its Parts Co., Lancaster, Pa. 20-page booklet presents illustrations, drawings and specifications or hollow-head set screws, lock screws, cap screws and bolts. Forms, dimensions and prices are quoted.

46 PERMANENT MAGNETS — The General Electric Co., Pittsfield, Mass. 8-page bulletin describes sizes and types and also installations of permanent magnets including Alnico, Cunife, Cunico, Vectolite and Silmanal. Engineering data and demagnetization curves are included.

MISCELLANEOUS

47 PRESSED METAL—Pressed Metal Institute, 829 Union Commerce Bldg., Cleveland, Ohio. 1948 supplement to Vol. 4 of the Blue Book of Stamping Manufacturers is available to stamping buyers. Listed in the supplement are names and facilities of members who joined the Institute since October, 1947 as well as present officers.

48 MICROCASTING—Austenal Laboratories, Inc., Chicago, Ill. 16-page booklet lists and illustrates parts suitable for manufacture by the microcasting process. Specifications of Vitallium castings produced by the process are given, including examples of intricate shapes cast.

49 CASTING—The American Machine and Foundry Co., New York, N. Y. 12-page booklet, an external house organ, presents information on the facilities, customers, equipment and products of the company.

50 SAFETY CHART—American Optical Co., Southbridge, Mass. New chart suggests proper respiratory protection against 150 specific dusts, vapors and gases and suggests uses of respirators approved by the U. S. Bureau of Mines.

THIS PART IS

BACKBONE

...and here's what BACKBONE gives you

The *backbone*, formed by the meeting of the two helices without a useless center groove, puts the entire face width of the gear to work. This means extra strength and higher load-carrying capacity in smaller space. In addition, *backbone* provides greater capacity for wear and shock resistance—especially important in heavy duty machine applications.

The Farrel-Sykes continuous tooth herringbone gear, the famous *Gear with a Backbone*, is made in any size up to 20 feet in diameter, for practically any application. Information and engineering help available, without obligation.

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Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Chicago, Los Angeles, Tulsa, Houston

FB-474

Comparison of tooth area between a Farrel gear (left) and conventional gear with center groove.

FARREL
The Gear with a Backbone

Farrel-Birmingham

FARREL CENTENNIAL

GANSCHOW CUT GEARS

SPUR—SPIRAL
BEVEL—RACK
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MEMBER OF AGMA

UP TO 60" PITCH DIA.
UP TO 10" FACE WIDTH

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Good Features
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43 Years' Experience

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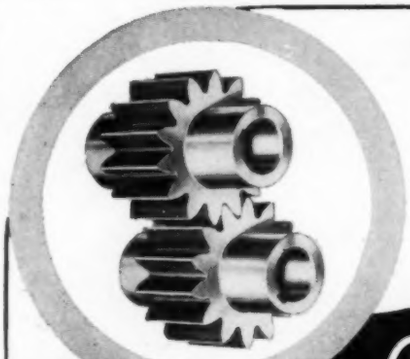
SHORTENS TEMPERS
RUINS MORALE—LOWERS PRODUCTION

Silent G-E nonmetallic gears reduce antagonizing gear noise. Two types are available to benefit a wide variety of applications. Both are strong, silent and resilient.

For complete information contact your gear cutter. For the bulletin, "Silent Gears," write to Section BG-9, Plastics Division, Chemical Department, General Electric Company, One Plastics Avenue, Pittsfield, Mass.

GENERAL ELECTRIC
CD48-03



★ SPUR
★ BEVEL
★ HELICAL
★ SPLINE
★ WORM
★ SPECIAL

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GROUND . . LAPPED . . SHAVED

We of the Cincinnati Gear Company are specialists in the manufacture of gears to meet your specific needs. Our modern plant is equipped with the finest and most accurate equipment for the control and production of Cincinnati *Gears, Good Gears Only.*

To provide the maximum in gear efficiency Cincinnati Gears, where needed, are ground, shaved or lapped. We can shave from 1" to 24" pitch diameter. To eliminate distortion after hardening, high-speed precision gears can be ground to provide the required accuracy.

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"Gears . . Good Gears Only"
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MP **QUALITY GEARS CUT TO ORDER** MP

• MEISEL produces but one *kind* of gears . . . gears constructed for specific jobs. Only through the inherent accuracy of this special designing could such dependability, performance and economy be possible. Tell us what you expect it to do, and we'll show you the one gear suited for your job.

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- ACCURACY OF THREADS
- LOW CHASER COST
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Bulletins available: General Purpose Die Heads, Insert Chaser Die Head, Threading Machines.

See our Advt. on Page 325 Mar. 11'48 American Machinist

THE EASTERN MACHINE SCREW CORP., 20-40 Barclay St., New Haven, Conn.
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Part: PULP STONE STUD
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Material: 1020 Steel

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on the REED A42
Cam-Actuated, Triple-Die
THREAD ROLLER

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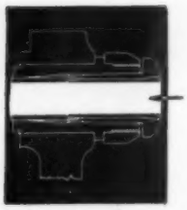
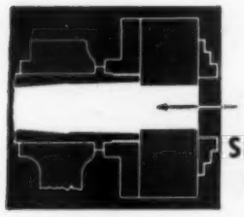


1" COLLET CAPACITY

No. 1003-Z Precision Bench Turret Lathe with 3-1/2 ft. bed; power feed universal carriage; handlever bed turret; double tool cross slide; compound rest cross slide; steel bench with oil pan and coolant return assembly; 3/4 h.p., 3 ph., 60 cycle, 220 volt motor and switch — f. o. b. factory $1309.35



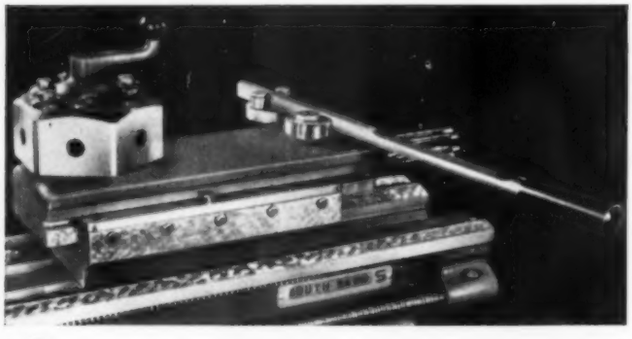
1-3/8" SPINDLE BORE

South Bend

SERIES 1000 PRECISION TURRET LATHE

This precision turret lathe is highly practical for manufacturing small precision parts. It meets the demand for fast, efficient production; yet it is easily adaptable to many classes of work. It has the stamina for exacting, close-tolerance operations; ample power for smooth performance; and the rigidity for producing a fine finish. Designed for the efficient production of duplicate parts, this lathe is especially suitable for second operation work.

For further information, contact our local distributor. His name is listed under "Machine Tools" or "Lathes" in your classified phone book. Or, write for literature.



HANDLEVER BED TURRET

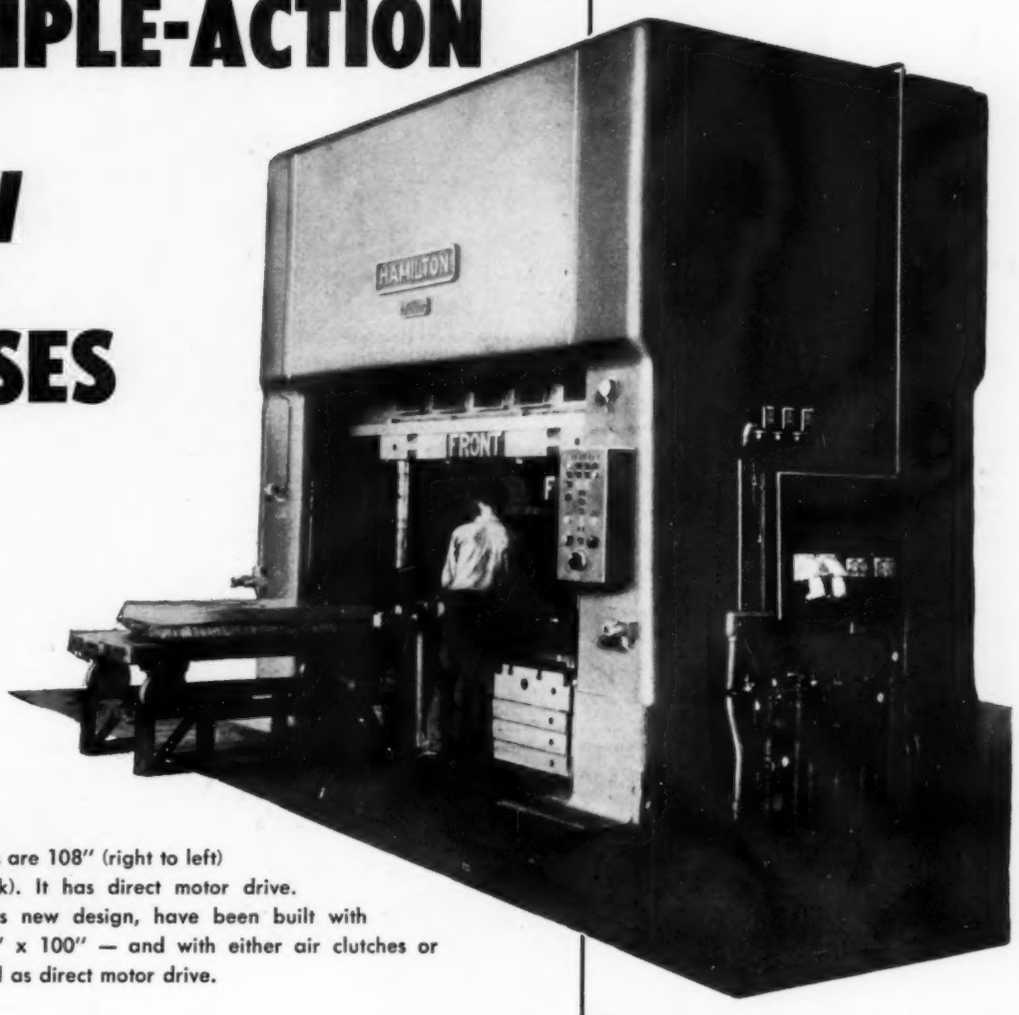
The precision construction of the turret assures perfect performance of turret tools. The turret will index within plus or minus .0005" measured 4" from the turret face. The index pin is hardened, ground and lapped. The turret head may be back-indexed or spun to skip tool positions. Individual feed stop screws accurately regulate the length of cut for each turret face. The maximum distance between spindle nose and turret face at start of indexing movement is 19-3/8". Adjustable gibs are provided on both sides of the turret slide.

SOUTH BEND LATHE WORKS

BUILDING BETTER TOOLS SINCE 1906 • 419 EAST MADISON STREET, SOUTH BEND 22, INDIANA

New Design

IN TRIPLE-ACTION DRAW PRESSES



Dimensions of this press are 108" (right to left) by 64" (front to back). It has direct motor drive. Similar presses, of this new design, have been built with dimensions up to 200" x 100" — and with either air clutches or dynamatic drive as well as direct motor drive.

Illustrated here is the lead press in a line of Hamilton presses producing automobile outer and inner door panel and pillar stampings. The operating mechanism of this new triple-action press is underneath, conveniently accessible from the basement for periodical inspection and servicing — thereby eliminating the hazards involved in performing these duties thirty or more feet above the factory floor.

The rod connections which actuate the two upper slides are in tension when the press is under load. This is an exclusive Hamilton feature which provides the means for improving the quality of the stampings, reducing sheet breakage, saving time in die setups and increasing die life.

Further information on the superior design and cost-saving features of Hamilton presses can be obtained from the Lima-Hamilton Corporation, Press Division, Curtis Building, Detroit 2, Michigan.

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DIVISIONS: *Hamilton, Ohio* — Hooven, Owens, Rentschler Co.; Niles Tool Works Co. *Lima, Ohio* — Lima Locomotive Works Division; Lima Shovel and Crane Division.

PRINCIPAL PRODUCTS: Hamilton heavy metal stamping presses; Hamilton diesel and steam engines; Hamilton-Kruse automatic can-making machinery; Niles heavy machine tools; Special heavy machinery; Heavy iron castings; Weldments; Locomotives; Cranes and shovels.

EASY DOES IT!

Here's an important job being done the easy way!
Steel and aluminum sheets are unloaded from cars on the siding of this large automotive manufacturing plant—moved first to storage, then to the shears and presses with speed and safety by a C-F Lifter.
When men and machines wait for material, in *this* plant, production stops and unnecessary costs begin. High grade sheets must be handled with care. C-F Lifters do not mar, crimp or deform sheets, because their wide carrying angles get *under* the load and *lift* it without pressure on the sides.
C-F Lifters are available in capacities from 2 to 60 tons or larger, in standard or semi-special designs.

Write for the new Bulletin "C-F Lifters"

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With the use of this Layout Fluid, you simply wipe the surface clean and brush it on. It dries instantly.

SEND FOR YOUR FREE SAMPLE of this Combination Brush-in-can. Please use your letterhead.

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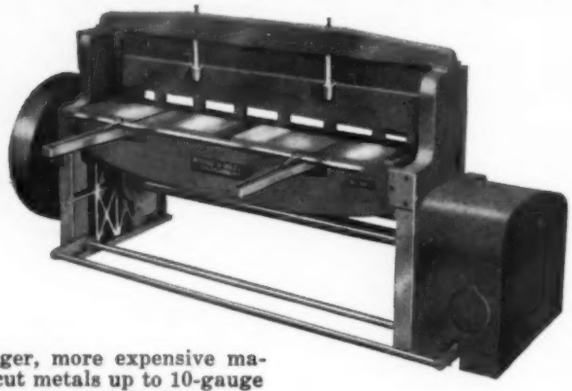
SPEED PRODUCTION, CUT OVERHEAD
with Wysong and Miles Power Squaring Shears



Using larger, more expensive machines to cut metals up to 10-gauge adds unnecessary production overhead. The Wysong and Miles 10 Gauge Shears, 6 foot and 8 foot in width, can do much of the work you are now routing to larger machines.

That's one reason the Wysong and Miles 10 Gauge squaring shears are ideal auxiliary machines. Relatively inexpensive, in both initial investment and operating costs, they are precision machines with an accent on accuracy and speed.

An important feature is the compensating holddown, with a spring actuated plunger in each foot. Even small strips are clamped firmly without adjustment.

The ball-bearing back gauge is set by a handwheel dial reading, adjustable to .0078 (1/128th) of an inch. Taper shearing is easily accomplished.

Another feature is the jaw-type clutch, so simple in design and operation that it requires only periodic lubrication. For safety and convenience, a non-repeat unit can be set to stop shearing action after each stroke.

Take time now to write for full information about the complete Wysong and Miles line of power squaring shears and other sheet metal machines. WYSONG AND MILES COMPANY, 623 FULTON STREET, GREENSBORO, NORTH CAROLINA

GRAY-MILLS

PORTABLE
PUMP UNITS

Use these compact self-contained units as

. . . Coolant Systems for all types of Machine Tools

. . . Stand-by Pump Units in case your built-in pumps fail

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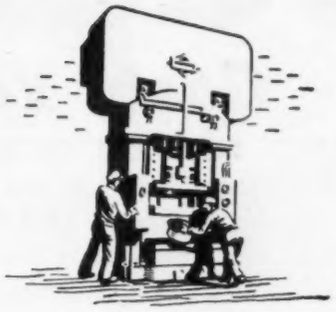
Bonderizing can make difficult draws *Smoother Easier Faster*



Problem draws in many plants have become routine production draws with Bonderizing used as an aid in drawing.

The nonmetallic, fine-crystal Bonderite coating holds lubricant, minimizes galling and scratching by eliminating metal-to-metal contact, and acts as an anti-flux.

Proper draws, higher drawing speeds, smoother finish, longer die life, less spoilage and fewer rejects: these are some of the benefits Bonderizing as an aid in drawing may bring to your production.

Steel washing machine tub, drawn from Bonderized blank at left above.

Send for Booklet today!

Get full information on Bonderizing as an aid in drawing. Send for your copy of free technical bulletin.

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Bonderite, Parco, Parco Lubrite—Reg. U. S. Pat. Off.

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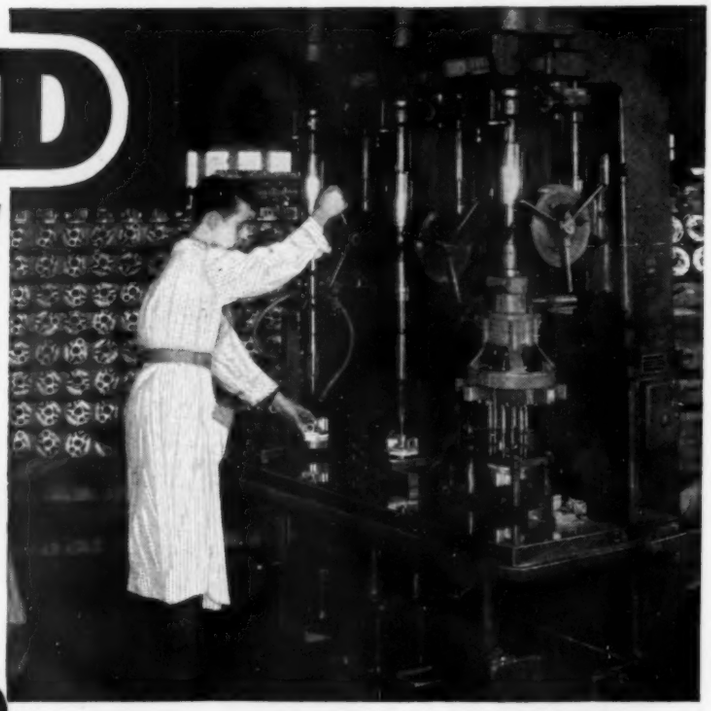
Gosh, Yes!

ASSOCIATED AIRCRAFT TOOL & MFG. CO., Hamilton, O., found that U. S. Drill Head's standard adjustable multiple spindle drill heads stood the gaff —and are still going strong after drilling 600,000 holes.



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HIGH RAPIDITY OF PENETRATION
.040" in 25 to 30 Minutes

SOLVES PROBLEM OF SELECTIVE HARDENING
by applying only to desired sections

NO SPECIAL FURNACES OR EQUIPMENT NEEDED
—even an open fire will suffice

ENORMOUS TIME SAVING
— repair units can be hardened right in maintenance shop. No special training required

CARBURIT IS NON-TOXIC

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ISOLATING PASTE

KEEPS DESIRED SECTIONS SOFT

While rest of workpiece is being hardened

REPLACES COPPER PLATING—
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JUST PUT ON AND KNOCK OFF
Saves time, money.

PREVENTS PENETRATION OF CARBON AND SLOWS DOWN COOLING OF COVERED SECTION.

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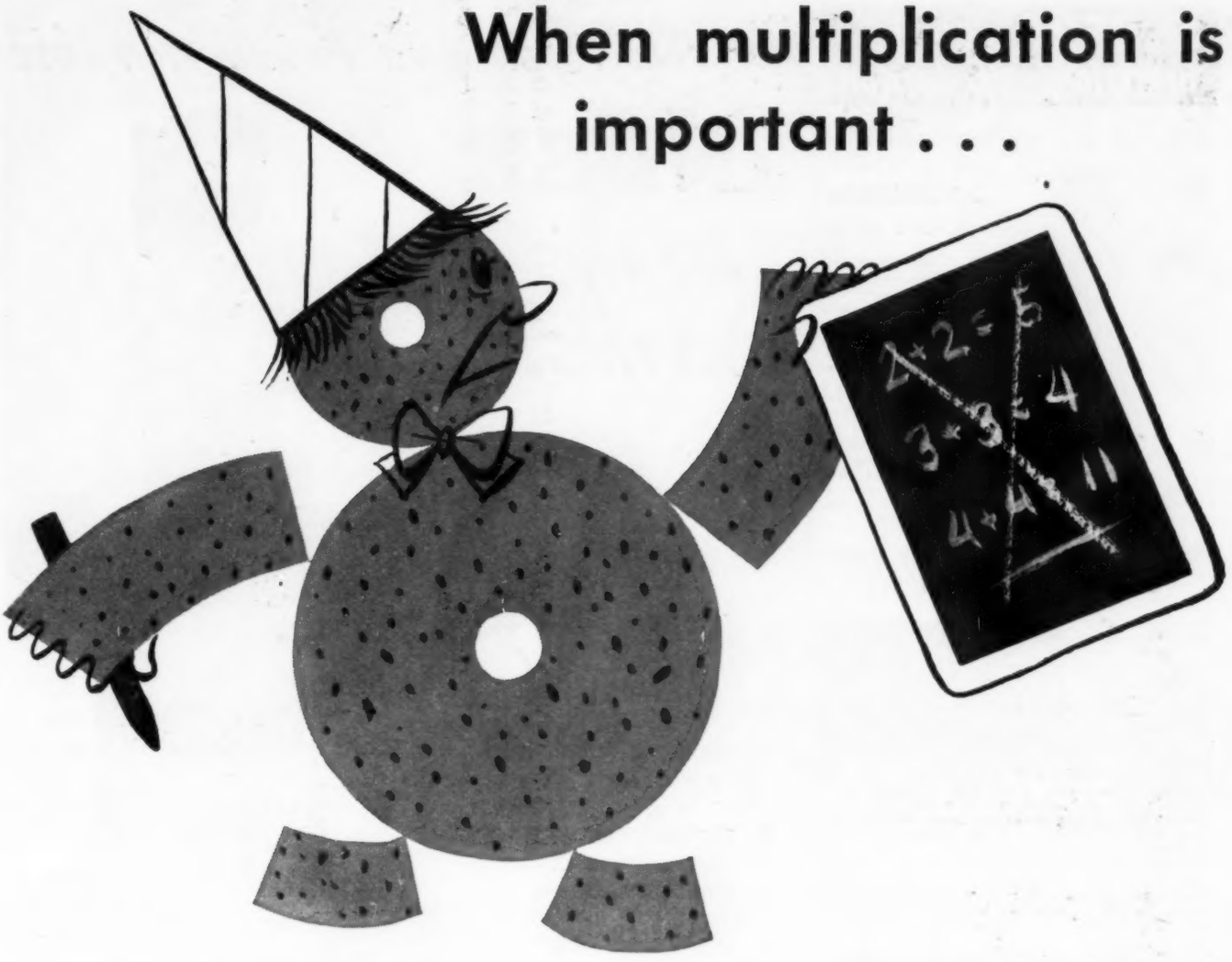

use ROBERTSON Grinding Wheels

Worried about production and increased costs? Have you examined your method of cost analysis? Are you designing products that can be ground instead of machined? Are you wasting time on your grinding operations?

Most important, don't neglect to give careful consideration to the selection of your grinding wheels. You'll find, in most cases, your best bet will be a Robertson Wheel. There's nothing superior to a Robertson for long wheel-life; fast, accurate production; and finish.

You can count on results like this from Robertson Grinding Wheels: A large manufacturing plant was grinding cotter-pins made from drop forgings. Taking off 1/16″ stock on a plunge cut, it was getting only 25 pieces per wheel-dressing. When a Robertson sales-engineer was called in, he studied the problem and recommended a Robertson SA 549-QV wheel. Immediately production rose to 125 pieces per wheel-dressing —an increase of 400 percent!

A sharp increase in production is not worth shouting about when it happens only once. Other users, however, are meeting with the same results: "Cuts grinding time in half" . . . "Production tripled" . . . "Reduces tool-grinding costs 10 percent to 20 percent." For all grinding operations—even the toughest ones—you'll get top results from Robertson vitrified-bonded or resin-bonded grinding wheels. Blueprint your problem, and let us recommend a wheel for your particular job.

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ROBERTSON MANUFACTURING COMPANY

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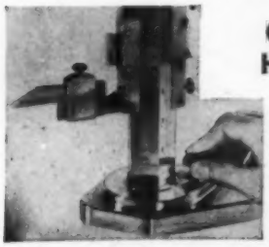
Resin-Bonded and Vitrified-Bonded Grinding Wheels • Mounted Wheels • Segments

SCHERR aids to precision – production

Will not shift while measuring—



CHESTERMAN HEIGHT GAGE

A big, sturdy stabilized instrument. Fine adjustment by screw operated from knurled nut on base (see photo) eliminates all chance of rocking or shifting instrument while measuring. Finger pressure on two lugs frees split nut for rapid up or down adjustment of the head. 2½" long vernier in place of the normal ⅝" vernier provides greater visibility without the need of magnifier or removing gage from work. Both English and metric readings, one on each face of column. Made in sizes from 12" to 48"—capacities sufficient for the most unusual measurements.

Makes gage blocks doubly useful

GAGE BLOCK UTILITY SET

Quick adjustable type holders. Greatly expands the usefulness of any set of standard gage blocks. The complete set includes four holders — 2", 4", 8" and 12", two jaws each for inside and outside measurements, a 60 deg., center point, a scriber point, and a substantial height gage base. Holders have no long projecting screws to make handling awkward. Every shop can profitably use one or more of these economically-priced sets, which will save their cost many times over by applying gage block accuracy at first hand, with no variation through the use of any other tool. Any parts of this set can be furnished separately at moderate cost. Set $98.50.

Two instruments for measuring cutting and wheel speeds—

Price, $67.50

SCHERR Hand TACHOMETER

Measures rpm without timing or calculation while held against end of rotating shaft. Any variation in speed caused by belt slipping, overload, etc., is instantly noted. Also have disc for measuring surface speeds in feet per min. Made for speeds from 30 to 12,000 changing speed range by new rotating shift mechanism. Other types to 48,000 rpm. Write for details.

SCHERR SPEED INDICATOR

Gives direct readings in rpm in a test requiring only 6 seconds. Needle remains at reading until released by pressure of button. Also measures linear speeds using disc attachment. Two types, ranges to 20,000 rpm. Full data on this and other Scherr speed measuring instruments on request

Price $37.50

Write for full details on these tools, and for the Scherr Small Tool Catalog.

GEO. SCHERR CO., Inc.

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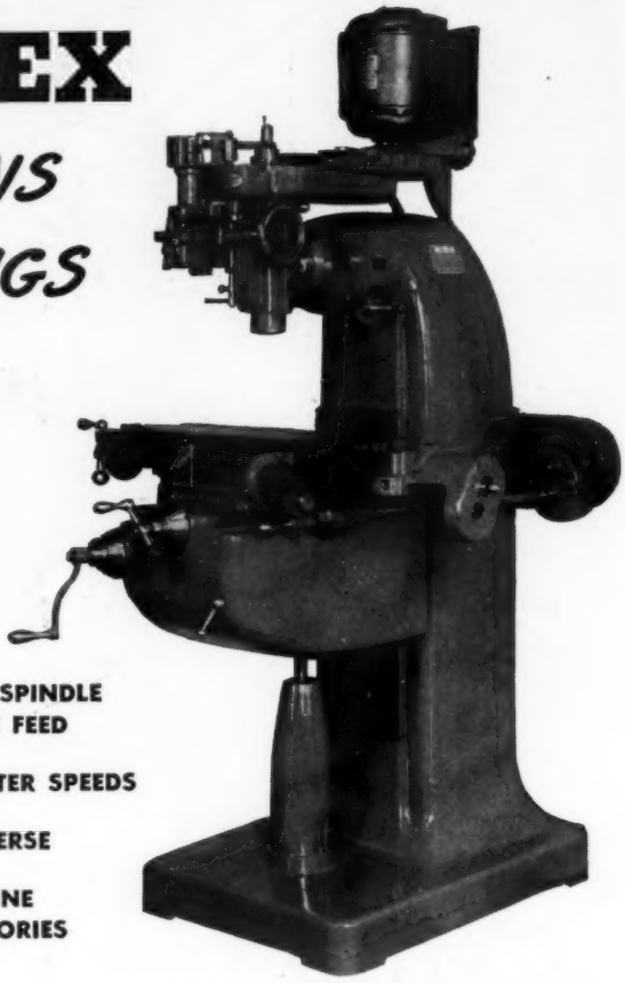
For Tool Room and Production Line

INDEX

MEANS SAVINGS



- **AUTOMATIC SPINDLE AND TABLE FEED**
- **TWELVE CUTTER SPEEDS**
- **RAPID TRAVERSE**
- **COMPLETE LINE OF ACCESSORIES**

Write for Literature or See Your Local Dealer

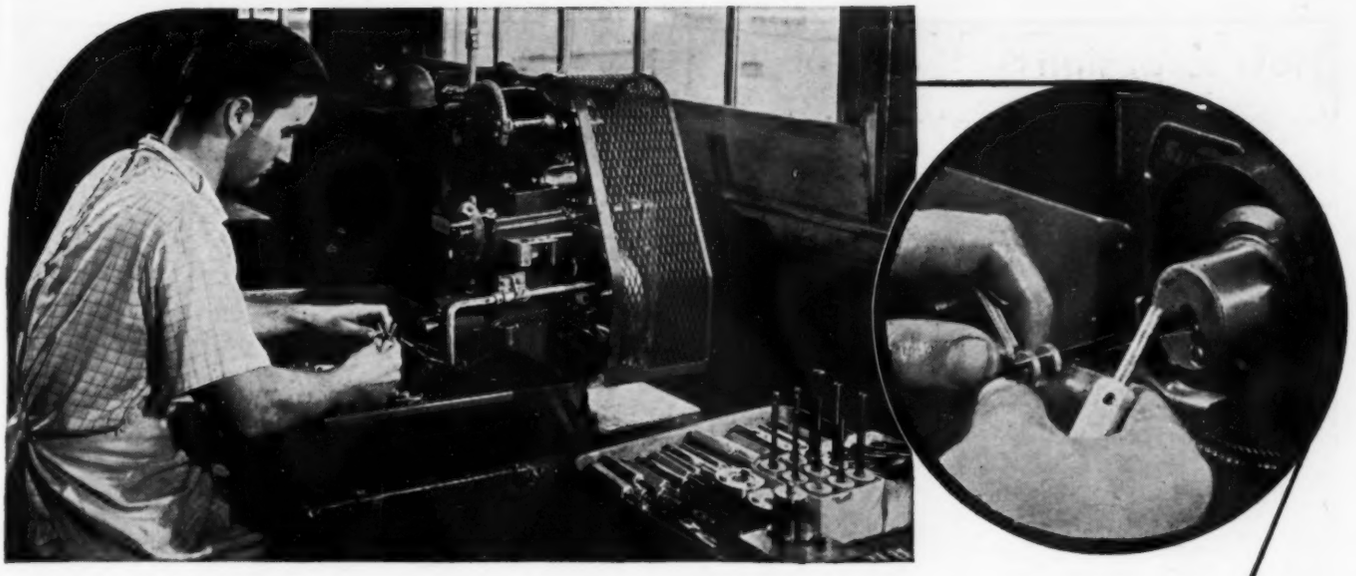
The Model 50 Index Milling Machine has a greater scope of usefulness than any machine of comparable size or cost, and offers substantial savings in production time and labor. It is tops for general tool room work, including locating and jig work. In addition, the machine's rigidity and freedom from chatter even under severe hogging cuts, plus the ease with which any necessary rate of feed can be obtained, and the rapid traverse for re-positioning, puts this machine definitely on the production line.

The complete line of accessories available, including end measuring rods, right angle milling head, and both hand and power operated precision rotary tables, further increases the usefulness of this machine.

NOTE: The reliable and time proven Model 40-H Index Mill still is and will continue to be available.

INDEX MACHINE CO.

540 N. MECHANIC STREET JACKSON, MICHIGAN



The National Cash Register Company Uses SUNNEN HONING

to Remove Burrs and Heat-Treat Distortion *Quickly* and at LOW COST

Some of the parts which are Sunnen Honed at The National Cash Register Company, Dayton, Ohio

Sunnen Honing is used by The National Cash Register Company to produce accurate internal diameters and smooth surfaces that contribute to the long trouble-free service of its products.

These Precision Honing Machines are used at National Cash Register on a wide variety of parts with holes ranging from ¼" to 1¾" in diameter. Tolerances for straightness and roundness as low as .0004" are easily held—production rates are high—and rejects are almost eliminated.

Sunnen Precision Honing Machines are a profitable investment wherever smooth accurate diameters must be produced:

- **Honing range from .120" to 2.625" in diameter —Including blind holes and bores with keyways.**
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- **Machine produces any surface finish required — no high spots, chatter marks.**
- **Fast set-up; quick change-over of sizes makes Sunnen honing profitable even on short runs.**

Write for bulletin or, on request, a Sunnen engineer will be glad to show you the advantages of Sunnen Honing in your plant.

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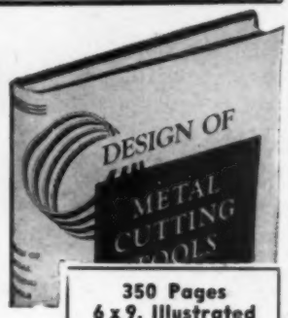
7932 Manchester Ave., St. Louis 17, Missouri • *Canadian Factory: Chatham, Ontario*

378

How to design efficient, money-saving **METAL CUTTING TOOLS**

This tool designer's handbook brings you "shop-tested" procedures and techniques.



350 Pages
6 x 9, Illustrated
$5.00

Here's a comprehensive new book packed with the information you need to successfully design today's high-precision, high-production metal cutting tools. A "must" for the tool designer, draftsman, engineer, shop superintendent and foreman it illustrates the fundamental principles by which all tools must be designed for successful operation. It places at your disposal the latest design techniques and procedures . . . practical data explained clearly with scores of easy-to-follow rules, tables, formulas, illustrations. Here's thorough design "know-how" for the most profitable application of tool to job . . . detailed information on the most effective uses of broaches, counterbores, countersinks, cutters, drills, form tools, hobs, punches and dies, reamers, shaper tools, single points, threaded tools.

Just Published

DESIGN OF METAL CUTTING TOOLS

By Frederick L. Woodcock

Chief Tool Engineer, Hamilton Standard Propellers Division of United Aircraft Corp.

Arranged for quick, everyday reference at bench, desk or drawing board this reliable manual gives the "how" and "why" of modern tool design. It draws on years of practical experience to bring you shop-tested methods for simplifying tool design, improving results, saving time and material, cutting costs . . . proven methods which show

BRINGS YOU PRACTICAL INFORMATION ON:

- Internal and external broaches
- Counterbores and countersinks
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- Gear and worm cutting hobs
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- Butt mills, cutting-off, deep recessing
- Spot facing, trepanning
- Punches and dies
- Reamers, single points
- Shaper tools for helical, herringbone or spur gears
- Dies for roll threading, screw cutting and taps
- Oils, coolants
- Conservation, conversion, salvage

—how to speed-up tool design and construction

—how to salvage worn out or obsolete tools

—how to convert tools for new jobs

—how to adapt jigs and fixtures to a new product

—how to cut costs of perishable tools

Tap this source of endless ideas to solve your own specific design problems . . . to keep up-to-date on the latest design techniques and procedures. Here are key designs that have a wide application in constructing intricate and delicate parts . . . includes such basic fundamentals of design as cutting elements, maintenance, inspection, sharpening cutting tool materials, heat treatments.

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Send me Woodcock's "Design of Metal Cutting Tools" for 10 days examination on approval. In 10 days I will send $5.00, plus a few cents postage, or return book postpaid. (Postage paid on cash orders.)

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"Hallowell" Solid Steel Collars, functionally proportioned throughout, are precision-machined so faces run perfectly true . . . are also highly polished all over . . . yet they cost less than common cast iron collars; 3" bore and smaller are made from Solid Bar Stock and fitted with the famous "Unbrako" Knurled Point Self-Locking Socket Set Screw . . . a set screw that, once tightened holds and stays tight to make sure the collar won't shift on the shaft. "Hallowell" . . . a "buy word" in shaft collars . . . available in a full range of sizes for

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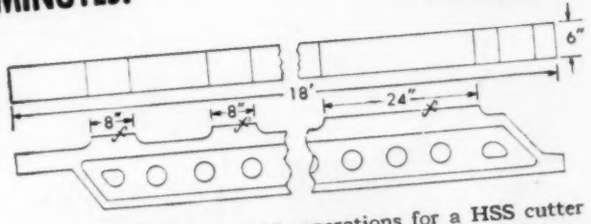
KENNAMILLING CUTS MACHINING TIME FROM HOURS TO MINUTES

ON STEEL

"UNIVERSAL" FACE KENNAMILL CUTS MACHINING TIME ON CAST STEEL BEAMS FROM 3 HOURS TO 24 MINUTES.



It took 3 hours and 2 separate operations for a HSS cutter and a carbide-tipped cutter to rough and finish mill four of these cast steel beams, having heavy sand inclusions. A "Universal" Face Kennamill removes the metal in one pass—gives superior finish—and reduces machining time 87%.

The "Universal" Face Kennamill is today's outstanding carbide cutter for milling steel. Its features include solid, advanceable Kennametal blades of tremendous strength and wear-resistance; a steel cutter body with precision-ground slots that support the Kennametal blades perfectly; and mechanical clamping that securely holds the blades with complete absence of strain.

ON CAST-IRON

AXIAL FACE KENNAMILL ROUGH AND FINISH MILLS IN ONE PASS. TURNS OUT 627 CYLINDER HEADS BEFORE REGRINDING.

This is typical performance by the Axial Face Kennamill—a total of 18,755 square inches milled on cast-iron cylinder heads before the blades required sharpening. Even then, the blades were in very good condition, and were reground only in order to maintain the high finish required on the manifold face of the piece.

The Axial Face Kennamill has solid blades of extremely abrasion-resistant Kennametal that give extended service without need for sharpening. It is designed for high rate milling with light or medium cuts on cast-iron. Grinding simplicity is one of its many cost-cutting features—it can be sharpened in a tool and cutter grinder, and usually only two surfaces on the blades need to be redressed.

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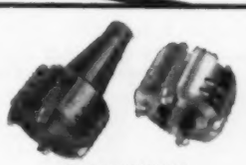
SUPERIOR CEMENTED CARBIDES

KENNAMETAL *Inc.*, LATROBE, PA.

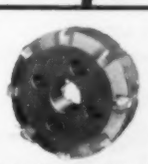
There are standard Kennamills available for most face milling operations. See particulars in Catalog 48. Write for your copy.

HALF-SIDE KENNAMILL
(Solid blades)

"CF" KENNAMILL
(Solid blades)



STEP KENNAMILLS
(Kennametal-tipped blades)



"ODD-JOB" FACE KENNAMILL
(Kennametal-tipped blades)

Immediate shipments from stock of U·S·S Carilloy Steels

— manufactured to a Guaranteed Minimum Hardenability

If you are a user of alloy steel, it is to your advantage to know that U·S·S Carilloy Steels in our stock are manufactured to a *Guaranteed Minimum Hardenability.*

And when you place an order with us for U·S·S Carilloy Steel you get an additional metallurgical service: *A Heat Treatment Guide which contains complete and specific information about the steel you receive is supplied you with each individual shipment.* This guide gives you *specific* data on the composition, potential physical properties and fabrication of the steel to help you obtain the maximum performance from the steel we furnish on your order.

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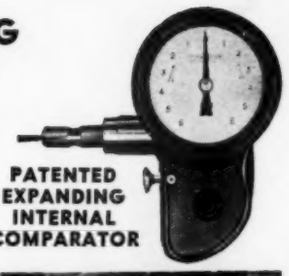
USS UNITED STATES STEEL

Here's COMTORPLUG the "Unrestricted" Internal Gage



Gages precision bores to fractions of .0001".

"Unrestricted" because—

COST is so reasonable as to be practical for all quantity gaging applications.

PORTABILITY. Available anywhere instantly. Weighs but a few ounces. No hose, wire or fixtures.

SKILL OF USER. Anyone can use it with complete precision after a few tries. Automatic centering and alignment and uniform pressure assure this—experience in many war plants proves it.

SCOPE. Measures holes ¼" to 8" dia. and larger, to fractions of one ten-thousandth. Shows true diameter and reveals out-of-round, front or back taper, barrel shape, bell mouth. Measures extreme bottom of blind holes.

DEFINITENESS. Not a passing reading, but a fixed, definite reading, assured by automatic features independent of human errors or variations of feel or judgment.

MACHINE OPERATOR

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WALTHAM, MASS.

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WHEN you order Oakite Composition No. 97 for machine precleaning of metals—*or* Oakite Composition No. 24 for tank cleaning *or* Oakite Composition No. 90 for electrocleaning *or* Oakite CrysCoat No. 87 for pre-paint treatment—you buy a lot more than a good solvent or alkaline or acidic material.

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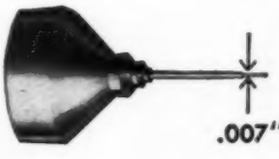
TRY THIS...

ON YOUR BEST TOOL ROOM LATHE!

Take a lathe—your best tool maker's lathe. Chuck a piece of ⅝" SAE 1050 Bar Stock. Sharpen up a tool and mount it in the tool post. Then turn the stock down to a diameter of .007" as is being done in the illustration above—a real job if you can do it, and if you do, you'll be certain your lathe has both rigidity and accuracy.



The piece pictured at the left was turned on a Hendey 9" x 24" Tool and Gage Maker's Lathe. You saw it done if you visited Hendey at the Machine Tool Show. You can see it done any day you choose to call on Hendey.

Though you may never be called on for such a job in your tool room it's a sure thing you can use a lathe that has all the properties needed for such a job. For full particulars write for the Hendey 9" x 24" Tool and Gage Maker's Lathe Catalog.

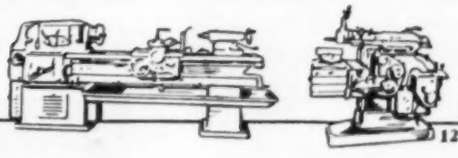
The Hendey Machine Company

Hendey

Main Office and Plant — Torrington, Connecticut

Offices — N. Y., Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco

Representatives in — Philadelphia, Cleveland, Pittsburgh



TOOL ROOM LATHES
9"-12"-14"-16"-18"-20"-24"

SHAPERS
12"-16"-20"-24"-28"

Goss & De Leeuw

THE WORLD'S FINEST MULTIPLE SPINDLE

Chucking Machines

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MILLER AND JIG BORER

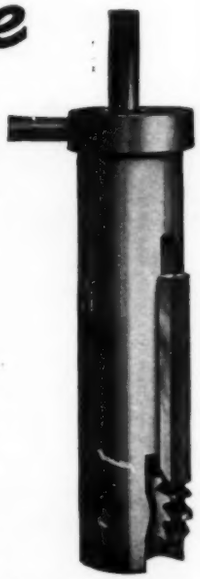
Handles a wide variety of toolroom jobs with speed, accuracy, efficiency . . . die work, jig and model making, drilling, reaming, milling. Releases larger machines for work better suited to their capacities. Easy set-up, quick changeover . . . velvet-smooth feed, eight spindle speeds from 275 to 4250 rpm. . . simple, direct micrometer setting.

FOR COMPLETE INFORMATION, WRITE FOR BULLETIN.

LINLEY BROTHERS CO., 664 STATE ST. EXTENSION BRIDGEPORT 1, CONNECTICUT

Investigate

THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER *on Your Work*



Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills—and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, and offset holes. We also manufacture oil-grooving millers.

WRITE today for Catalog No. 16

NATIONAL MACHINE TOOL CO.

CINCINNATI 22, OHIO

DIES LAST LONGER ON FERRACUTE INCLINABLE PRESSES

Extra long gibs guide tools accurately, give extra long life for dies.
Unusually heavy frame reduces deflection, lengthens die life . . . .

Ferracute Presses "never wear out." You can figure on lower maintenance on every set of dies you buy in the next 50 years. Choose economical, low-maintenance Ferracute Inclinables for your utility press line-up. For cutting, punching, blanking, stamping, shallow drawing and forming. Models from 5 to 150 tons.

- *Write for full specifications and information.*

Check these additional features that will lower your costs:

- *Ferracute low-maintenance clutch.*
- *Adjustable ground gibs and ram.*
- *Ample shut height.*
- *Safety flywheels.*
- *Quick application of standard roll feeds.*
- *Back shaft equipped with roller bearings on larger presses.*
- *Bronze bushed.*
- *Air ram balance can be applied easily.*
- *Quick, easy change-over from single stroke to continuous operation.*
- *Immediate or very prompt delivery.*

FERRACUTE MACHINE CO., Bridgeton, N. J., U. S. A.

BUZZER INDUSTRIAL *Gas* EQUIPMENT

*Reg U.S. Pat. Off.

No Blower or Power is needed to reach High Temperatures with a "BUZZER" Gas Furnace . . . just connect to your gas supply.

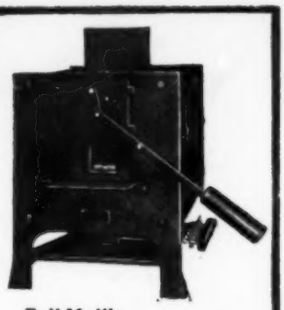
Rectangular Heat Baths

For liquid heat treating baths, soft metal melting, etc.

The High Speed Full Muffle Furnace attains a temperature of 2400° F., and is designed for High Carbon and Alloy Steels.

BUZZER Rectangular Heat Baths meet the increasing demands for large liquid Heat Bath Furnaces, and are built in many sizes. Also made in round type pot furnaces

Send for the new BUZZER Catalog showing full line of Gas Furnaces, Burners and other equipment.



Full Muffle Furnace (Bench Type)

CHARLES A. HONES, INC.

121 South Grand Avenue **Baldwin, L. I., N. Y.**

Save Hands Speed Production with—

LITTELL

Pres-Vac Safety Feeder

KEEP workmen's hands out of Danger Zone. Use PRES-VAC Safety Feeders to keep hands safe, improve quality and speed production. Pres-Vac acts on trigger-vacuum principle. Picks up—drops—material instantly. Uses compressed air, 10 to 45 lbs. pressure.

Littell makes a complete line of pressroom equipment, including: Reels, Roll, Dial and Magazine Feeds; Straighteners; Air-Blast Valves; Scrap Winders, etc. *Request Bulletins.*

F. J. LITTELL MACHINE CO.

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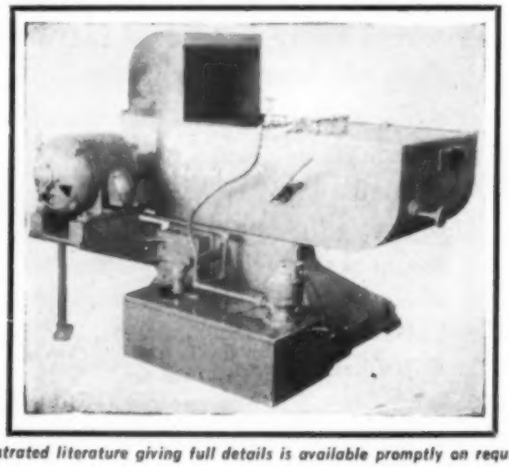
Only Reliable Products Can Be

Continuously Advertised

Lower Cost Flat Surfacing of all Materials . . . on the No. 3 W-20" "PEERLESS"

This machine, for wet or dry surfacing, is adaptable to the flat surfacing of such materials as die castings, plastics, cast iron, steel, alloys, ceramics, rubber, glass, fibre, etc. It provides high surface speeds and a large working surface. The waterproof abrasive belt is 20" wide and the available operating surface on the work table is 20"x30".

Large parts can be oscillated easily and conveniently with minimum effort on the part of the operator. Made also in a 14" size.



Illustrated literature giving full details is available promptly on request.

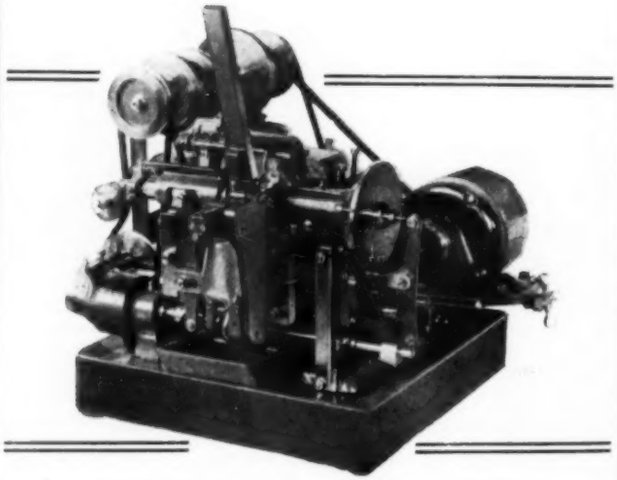
See our exhibit—Space 1327—National Metal Exposition, Phil., Oct. 25-29

Production

MACHINE COMPANY GREENFIELD, MASSACHUSETTS, U.S.A.

WALTHAM

PINION AND GEAR CUTTING MACHINES



Fast, Convenient, Compact, Accurate

Designed to make high speed production of small gears and pinions available for assembly in watches, instruments, gauges, fuses, etc. Made in Single-Cut, Multiple Cut and Magazine-Feed types. Simple to operate; require no special skill.

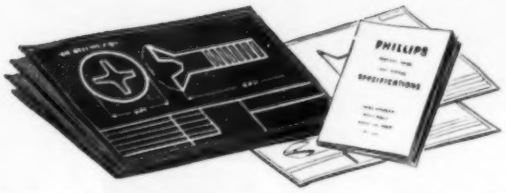
Send for detailed information and complete specifications.

WALTHAM MACHINE WORKS

Waltham, Mass.

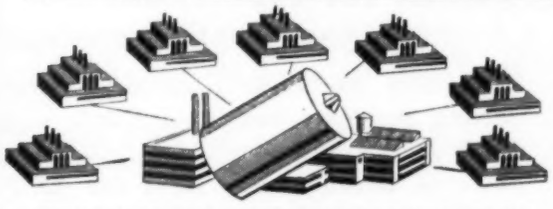
ONLY PHILLIPS RECESSED HEAD SCREWS

OFFER DIMENSIONAL UNIFORMITY INSURED BY CLOSE ENGINEERING CONTROL

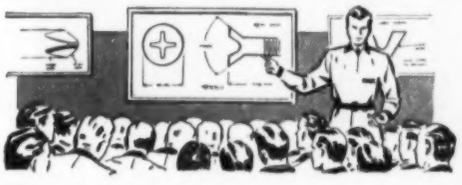


ESTABLISHED STANDARDS . . . Every manufacturer of Phillips Cross Recessed Head Screws is supplied with complete engineering and production data which prescribes precise dimensions and tolerances.

CENTRALIZED PRODUCTION TRAINING . . . And, before production is started on Phillips Screws, each plants' supervisory staff puts in an extended training period with Phillips engineers.



COMMON SOURCE OF RECESS FORMING TOOLS . . . Punches for forming the Phillips Cross Recess in all types and sizes of Phillips Screws are formed from master types at one plant. The manufacture of gauges for maintaining uniformity of Phillips Drivers and Bits are similarly centralized.



ENGINEERS' MEETINGS . . . Standards carefully established at the very beginning are rigorously maintained through meetings of "Phillips Recessed Head Standards Committee". Engineers from all plants meet to exchange ideas, discuss problems and learn about recent developments.

All these precautions to secure absolute dimensional uniformity are just part of the care taken to produce Phillips Cross Recessed Head Screws that give users *all* the advantage of a cross recess engineered for practical production.

Speed and ease of driving in production assembly demands that the driver and recess fit smoothly, perfectly, the same way every time, all the time. With Phillips Screws, you can depend on it.

GET ALL THE ADVANTAGES OF ASSEMBLY WITH CROSS RECESSED HEAD SCREWS . . .

GET PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

25 SOURCES

American Screw Co.
Central Screw Co.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
Elco Tool & Screw Corp.
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Sterling Bolt Co.
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GET THIS NEW BOOKLET of facts that prove the top value, top economy of Phillips Recessed Head Screws. It's free . . . use the coupon.

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c/o Horton-Noyes Co.
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Send me the new booklet—"How to Select Recessed Head Screws for Practical Production Driving".

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Company _____

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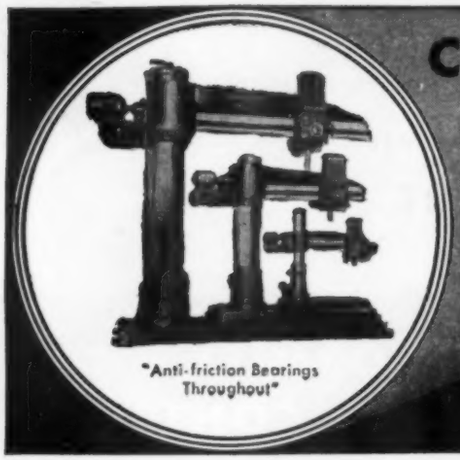

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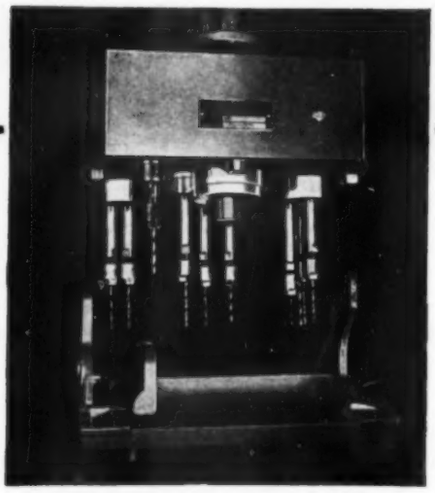
FEATURES: 1. Low Hung Drive to Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all Speeds. 4. Concentrated and Convenient Push-button Controls. 5. Constructed on Unit Principle.

THE CARLTON
MACHINE TOOL COMPANY

CINCINNATI 25, OHIO, U. S. A.



Shown is a ten spindle multiple drilling head, drilling ten varied size holes on different elevations. The head has grooved thrust ball bearings at all thrust points and hardened bronze radial bearings. Heat treated spindles and gears of one piece turned from solid bar stock. It is geared approx. 2:1. All encased in a sand cast aluminum case and cover, with alemite pressure lubrication.

Send us your blueprint, sketch, or sample for a quotation.

also: Multiple Tapping Heads, Adj. Drill Heads, Cone and Clutch auto Reverse Tapping Heads from No. 2 to 2" cap., Opening die heads, Stud Setters, and Quick Change Tool Holders.

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consult *our* experts on *your* tooling problems

Give them the toughest and most intricate tooling problems you have. Their experience and knowledge will give you the right answers because they have the KNOW-HOW in this field. Get in touch with Columbus Die-Tool Co. today.

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BUILDING COMPLETE MACHINE TOOLS
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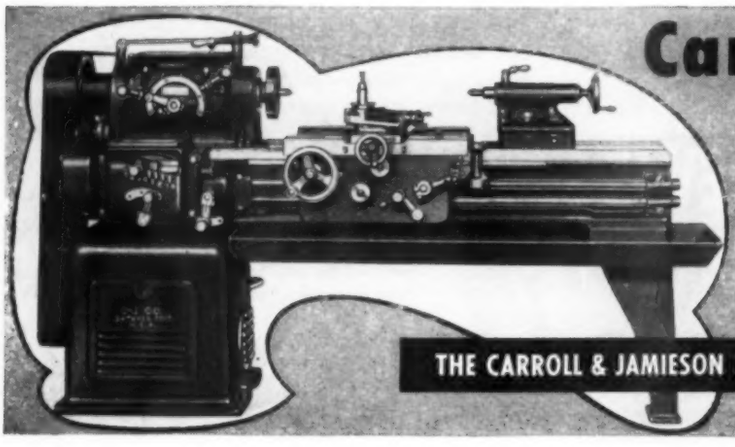


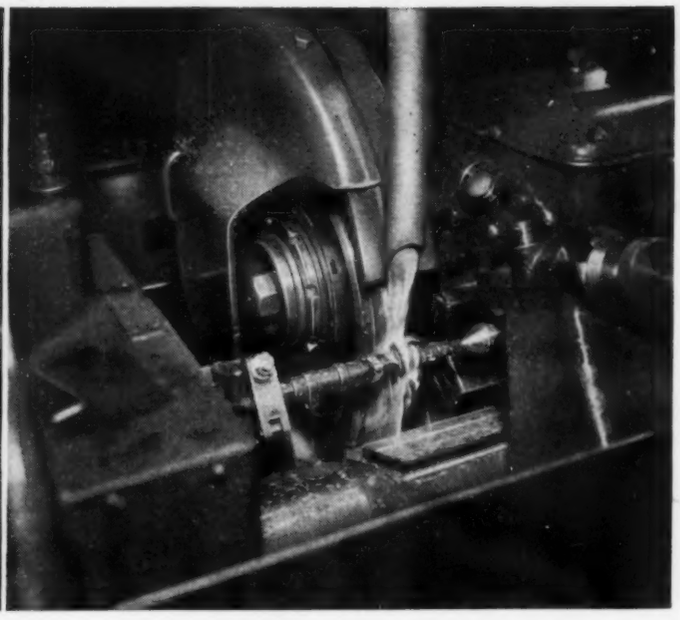
Carroll & Jamieson
16" LATHE

12 Speed Geared Head Motor Drive
Timken Mounted Spindle
Modern Design—
Liberal Dimensions

WRITE FOR BULLETIN

THE CARROLL & JAMIESON MACHINE TOOL CO., BATAVIA, OHIO, U. S. A.

Cities Service cutting oil specialists have helped make turret lathe production more profitable for many of our customers



In cam lobes grinding as in other grinding operations Cities Service Soluble fluids make fine finish possible with fewer rejects.

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CITIES SERVICE

QUALITY CUTTING FLUIDS

Experienced users of cutting fluids generally agree that with correct tooling and the right type of cutting fluid they can usually count on the following gains:

- ★ **Longer tool life**
- ★ **Better finish**
- ★ **Closer tolerances, greater accuracies**
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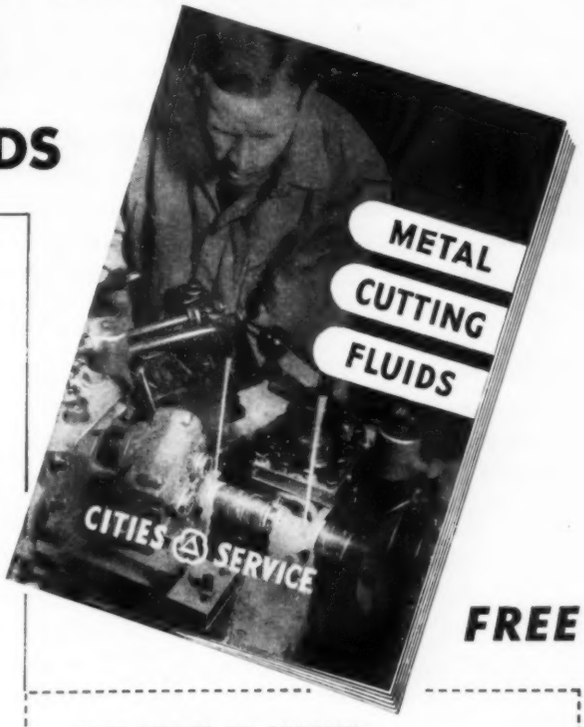
- ★ **Produce more pieces between tool regrinds**

Why not find out what the right type cutting fluid will do for you?

Just Mail This Coupon ➧



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SIXTY WALL TOWER
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NEW YORK 5, N. Y.

Please send me without obligation your new booklet entitled "Metal Cutting Fluids."

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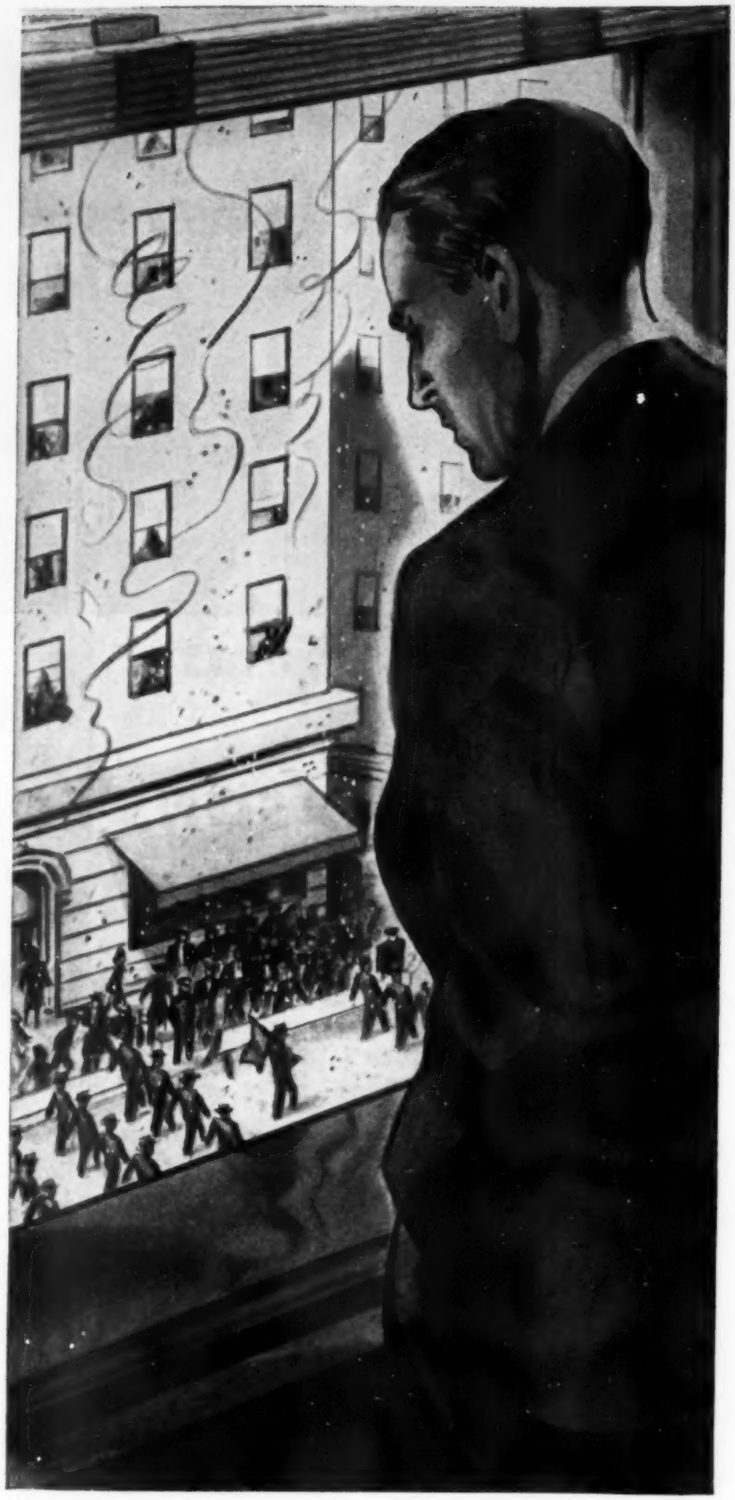
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

MEMO TO PRESIDENTS WHO WATCHED THE BAND GO BY!



HERE'S ONE parade that isn't "all over but the shouting" after the band has passed. It's the Payroll Savings Plan for the regular purchase of U.S. Security Bonds by employees.

Though the formal spring campaign to sell Bonds is over, any company can still move forward with the parade. Right now thousands of companies are putting *additional push* behind their Payroll Savings Plans. Managements of many companies that have not yet participated are *now installing* the Plan.

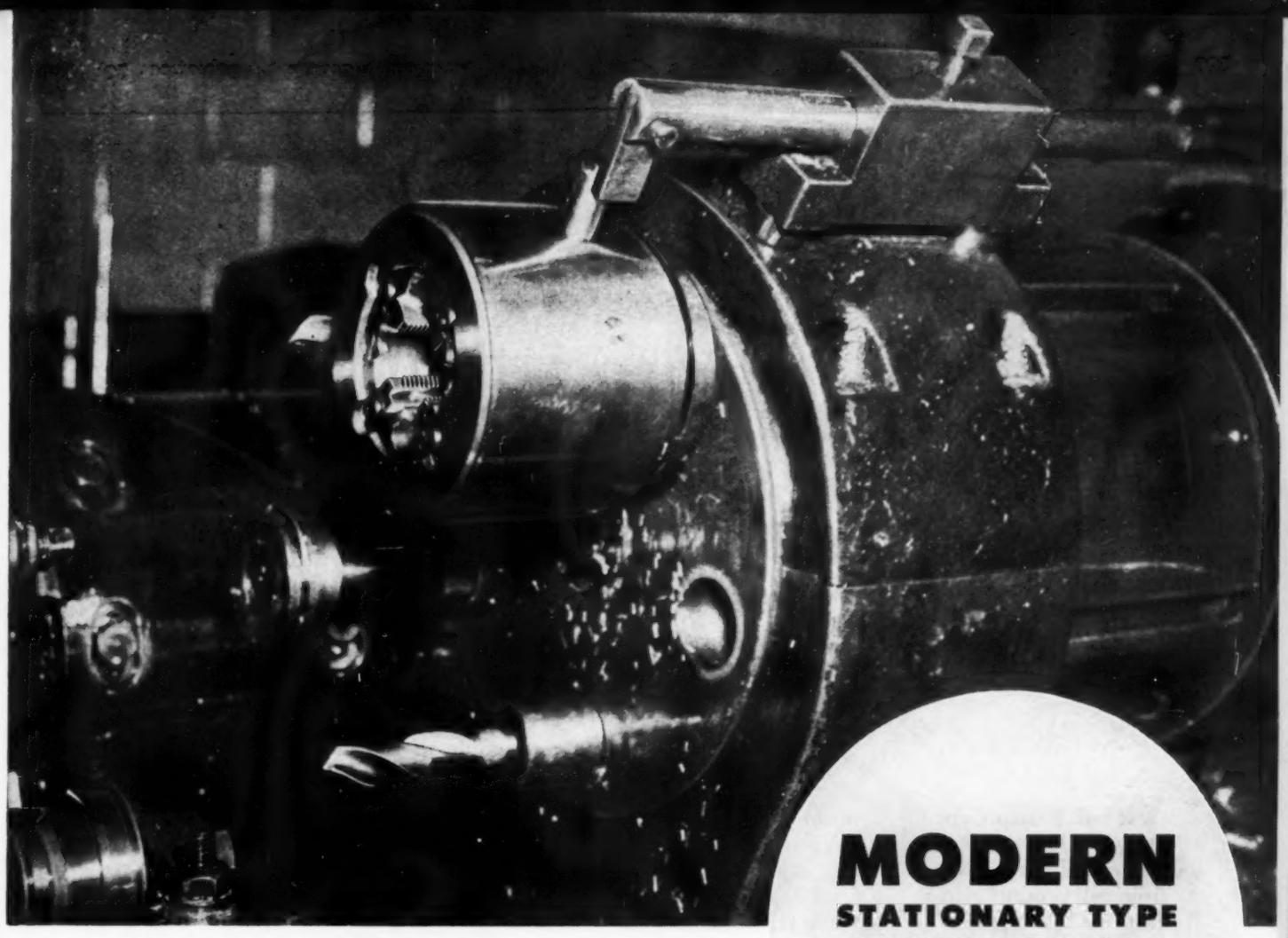
It's a "look-ahead" plan, that benefits employee, company, and nation. Every $3 invested in Bonds pay $4 at maturity. Personnel records in the plants with active P.S.P. programs show improved employee attitudes—evidenced by less absenteeism and fewer accidents—as the individual's sense of security grows with Bond purchases. And every Security Bond dollar built up in the Treasury retires a dollar of the national debt that is potentially inflationary. It means less bidding-up of prices. Moreover, Bond buyers are better citizens because they have a tangible stake in the nation's future.

It's just as easy to take action now as when the campaign was at its height. Just call your Treasury Department's State Director, Savings Bonds Division, and ask for the material that helps to get a Payroll Plan started or to keep it rolling.

The Treasury Department acknowledges with appreciation the publication of this message by

American Machinist

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and the Advertising Council.



MODERN
STATIONARY TYPE SELF-OPENING DIE HEADS

Here a Modern Stationary Type Self-Opening Die Head is shown in operation on a Cleveland Automatic. The die head's floating shank compensates for any difference between the lead of the cam of the machine and the thread to be cut.

Modern Precision Tools Include . . . . .

- STATIONARY SELF-OPENING DIE HEADS
- ROTARY SELF-OPENING DIE HEADS
- STATIONARY COLLAPSIBLE TAPS
- ROTARY COLLAPSIBLE TAPS
- MODERN-MAGIC CHUCKS AND COLLETS
- SELF-OPENING STUD SETTERS
- INSERTED BLADE FACE MILLING CUTTERS
- SOLID ADJUSTABLE DIE HEADS
- ADJUSTABLE HOLLOW MILLING TOOLS
- UNIVERSAL CHASER GRINDING FIXTURES

The line of standard Modern Stationary Type Self-Opening Die Heads thread diameters from 1/8" to 7" in standard heads and up to 14" in special heads, accurately, fast and economically. They are adapted to practically every thread cutting operation within their capacity. Designed for use in hand screw machines, turret lathes and other machines where the die head is used in a stationary position and the work revolves.

Complete information will be furnished upon request.

MODERN TOOL WORKS

DIVISION OF

CONSOLIDATED MACHINE TOOL CORPORATION

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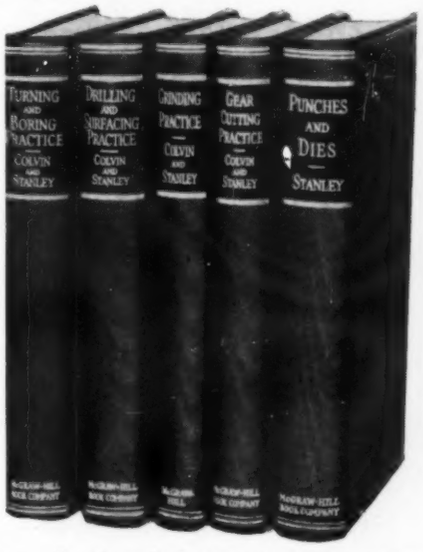

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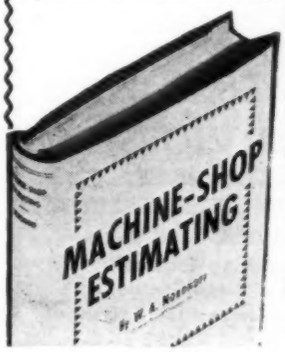

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3' CINCINNATI-BICKFORD, AC MD thru gearbox
4' MORRIS, MD
6' CINCINNATI-BICKFORD mtr on arm
7' DRESES, 17" col., AC MD thru gearbox

GRINDERS

#16—26" BLANCHARD Vert Spdl Surf, AC MD
8"x18" CINCINNATI Saddle Type Cyl., AC MD
#2 BROWN & SHARPE Universal, AC MD
#24—53" GARDNER Tub Type Vert Spdle Disc, AC MD
#3 CINCINNATI Centerless, new 1943

BORING MILLS

#3A UNIVERSAL Horz. 3" bar, SPD
#43 LUCAS Horz., AC MD, 4½" bar, 20' betw faceplate & outer support
36" BULLARD "New Era" Vert. Turret Lathe, AC MD

GEAR MACHINERY

#1 ADAMS Hobber, AC MD
#3 ADAMS Hobber, belt
#18H GOULD & EBERHARDT Hobber, AC MD
#34 BROWN & SHARPE Hobber, AC MD
#61 FELLOWS Shapers
#6—60" BROWN & SHARPE Cutter

TURRET LATHES

#2B FOSTER Univ. Grd Hd, SPD
#3A WARNER & SWASEY Univ., long bed, AC MD
#4-W CINCINNATI ACME Univ., AC MD, thread chasing

MISCELLANEOUS

10'x10 ga. OHL Power Press Brake, AC MD
#2 WATERBURY-FARRELL Thread Roller, AC MD
1-7" BULLARD 8-spdl Mult-Au-Matic, AC MD
2½" LANDIS Double Head Bolt Threader, AC MD
10" PRATT & WHITNEY Vert. Shaper
INGERSOLL-RAND XB2 Air Compressor, 888 cu. ft., AC MD

YOUR INQUIRIES SOLICITED

COX MACHINERY CO.,

P. O. Box 1953 CINCINNATI 1, OHIO

OFFICE AND WAREHOUSE: 311-313 Bakewell St. Covington, Kentucky
Three minutes from the Cincinnati hotel district

BARGAINS!

SURPLUS EQUIPMENT

BRIDGEFORD 36x24' Centers Engine Lathe, Motor Drive
BULLARD 16" 6 and 8 spindle Mult-au-matic Type D Single Indexing, New 1943
CINCINNATI 120x96x26' Table Housing Planer, 4 hds., PRT Box Table, DC, MD

CINCINNATI #4 Plain Milling Machine Geared Timken Bearing

CINCINNATI #3, #4 Vertical Milling Machine, Geared Motor Drive
CRANES from 5 to 30 ton capacity all 230 volts, DC current
FRANKLIN 4¼" Bar Horiz. Bor. Mill, MD
HEALD #48A Borematic Double Spindle
JONES & LAMSON "Fay" 20x25 Centers Production Lathe, New 1941
LoSWING 8x108" Cen. Prd. Lathe, New 1941

NIAGARA 1000, 1200 KVA Transformers, New 1941

NILES 30x50' Bed Boring Lathe, New 1941
NILES 72x63' Centers, Combination Boring and Turning Lathe, Motor Drive
SUNDSTRAND #3A Duplex Miller—40" feed, New 1941
VAN NORMAN #3 Duplex Univ. Milling Machine
WARNER & SWASEY Univ. Turret Lathe Timken Bearing

This is a partial listing. More than 1,000 other items for immediate delivery. Our prices cannot be duplicated. We Solicit your inquiries.

HARRISON MACHINERY EXCHANGE, INC.

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Eastern OFFERS FROM STOCK

DEVOTED EXCLUSIVELY TO REBUILT MACHINERY

RADIAL DRILLS

3'-10" Morris, m.d., gear box, inclosed head
3' American Sensitive, cone
4'-13" American Triple Purpose, gear box, inclosed head
4' American Sensitive, m.d. on arm
4'-12" Fosdick, gear box
4' Niles-Bement-Pond Semi-Universal, m.d.
5' American Triple Geared, 13" col., gear box
5'-15" American Triple Purpose, gear box m.d.
5'-13" Cincinnati-Bickford, m.d.
5' Cincinnati-Bickford Full Universal, gear box
5' Cincinnati-Bickford Plate Hole Driller, m.d. on arm
5' Prentice Plain, m.d.
6'-15" Carlton, gear box, inclosed head
6'-15" Cincinnati-Bickford, with 7' arm, m.d.
6' Niles-Bement-Pond Semi-Universal, m.d.
6'-16" Western, m.d.
7'-17" Dreses, gear box m.d.
8'-16" American Triple Purpose, m.d. on arm
8'-19" American Triple Purpose, m.d. on arm, 1942 machine
10'-2" American Triple Purpose, m.d. on arm

UPRIGHT DRILLS

20" Barnes All Geared, m.d., tapper
21" Cincinnati-Bickford, m.d., tapper
21" Fosdick, m.d., tapper
24" Cincinnati-Bickford, belt, tapper
30" Rich H.D., m.d.
H3 Barnes Hydram, m.d.
D4 Colburn H.D., m.d.
D8 Colburn H.D., m.d.
No. 25 Foote-Burt, m.d.
No. 36H0 Baker M.D., m.d.
No. 217 Baker H.D., s.p.d.

GEAR SHAPERS

No. 6, 61, 645 Fellows, belt
No. 7, 7A Fellows, m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 61A Fellows, m.d., latest type
No. 64-S Fellows, m.d.
No. 65A3 Fellows, m.d., latest
No. 615A Fellows, m.d., latest
No. 645A3 Fellows, m.d., latest

GEAR GRINDERS

9" Pratt & Whitney Hydraulic Spur, m.d.
10" Pratt & Whitney Hydraulic Spur & Helical, m.d.
No. 2HS Lees-Bradner Spur & Helical, m.d.
No. 13LS Fellows Gear Lapper, m.d.

GEAR HOBBING MACHINES

Barber-Colman Model T, m.d., latest
No. 12H Gould & Eberhardt Universal, m.d.
No. 34 Brown & Sharpe, m.d.
No. 44 Brown & Sharpe Spur & Spiral, m.d.
48" Cleveland, m.d.

GEAR CUTTERS

No.3—26" Brown & Sharpe, m.d.
No. 4—48" Brown & Sharpe, m.d.
No. 6—72" Brown & Sharpe, m.d.
3" Gleason Straight Bevel, m.d.
8" Gleason Mfg. Type Straight Bevel, m.d.
11" Gleason Straight Bevel, m.d.
12" Gleason Straight Bevel, m.d.
Gleason Spiral Bevel Gear Rougher, s.p.d.
Cincinnati Gear Burnisher, m.d.
No. 1 Brown & Sharpe Spur Gear Tester
National Broach & Machine Co. Red Ring Gear Speeder, 10" cap.
Cross Gear Rounder, m.d., 9" cap.
Gleason Gear Tester for hypoid gears

CENTERLESS GRINDERS

No. 2 Cincinnati Centerless, m.d., Filmatic Spindle, Latest
No. 2 Cincinnati, m.d., older type
Long bar attachment for No. 3 Centerless
Cincinnati Valve Seat Grinder, cap. 3/8" valve stems, m.d.

CYLINDER GRINDERS

No. 50 Heald Hydraulic, m.d., 11-18" spindle
No. 55 Heald, m.d., 15-24" spindle
No. 73 Heald Airplane Cylinder Grinder, m.d., brand new, latest type

BROACHING MACHINES

No. 4 Oil Gear Hydraulic, m.d., 64" stroke
No. 4 LaPointe of Hudson, gear box
No. 75 H.P. LaPointe Horizontal Hydraulic, 150" stroke, 37½ tons cap.
Cincinnati Mill Broach, m.d., 10" spindle, new

BALL BEARING DRILLS

2 spindle 21" Canedy-Otto, m.d., No. 4 Taper
Walker-Turner Bench Type, m.d.
No. ½, 1, 2 Avey, belted m.d.
No. 1B Edlund, m.d., new
No. 5M—16" Fosdick, m.d.
2 spindle No. 3 Avey, belted m.d., p.f.
3 spindle No. ½ Heavy Avey, direct m.d., latest
4 spindle No. 2 Avey, belted m.d.
6 spindle Leland & Gifford, No. 2, m.d. on each spindle
6 spindle No. 2B Edlund, m.d., No. 2 Taper
6 spindle Henry & Wright Class B, m.d., No. 2 Taper

HORIZONTAL DRILLS

No. 1½B Pratt & Whitney 2 spindle Rifling Machine, m.d., latest
No. 410—2 spindle Barnes Deep Hole Drill, m.d.
No. 6 Barnes 2 spindle Honing Machine, 16' travel, m.d., latest
No. ½Bx30" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d.
No. ½Bx50" Pratt & Whitney Deep Hole Drill, m.d., latest
No. ½Bx50" Pratt & Whitney 6 spindle Reaming Machine, m.d., latest
No. 1B-50" Pratt & Whitney 2 spindle Deep Hole Drill, m.d., latest
No. 1 Pratt & Whitney 2 spindle Deep Hole Drill, m.d.
No. 1½x105" Pratt & Whitney 2 spindle Deep Hole Drill, m.d., latest
No. 1½ Pratt & Whitney 2 spindle, m.d., older type
Pratt & Whitney Rifling Machine, belt
5 spindle Detroit Semi-Automatic Drill, belt

MULTIPLE SPINDLE DRILLS

No. 3 Baush, m.d., 16x30" head, 15 spindles
No. 3 Baush, m.d., 20x40" head, 15 spindles
P7 Baush Hydraulic, m.d., 20x30" head, 12 spindles
D13H Natco Hydraulic, m.d., 18x12" head, 10 spindles
No. 17 Fixed Center Foote-Burt, m.d.
3 spindle 24" Barnes All Geared Self-Oiling, m.d.
3 spindle 12" Rockford Gang, m.d.
4 spindle Foote-Burt Rail, No. 4 Taper, m.d.
4 spindle Niles-Bement-Pond H.D. Rail, m.d., 12' rail, No. 5 Taper

AUTOMATICS

8 spindle 1⅜ Cone, m.d., latest
4 spindle 1¼" Conomatic, m.d., bar, 1942 machine
No. 4D Potter & Johnston, m.d., air chucks, late
No. 5D2—12" Potter & Johnston, m.d., air chucks, 1944 machine
No. 5D2—15" Potter & Johnston, m.d., air chucks, 1944 machine
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
14" Fay, Flanders Type, m.d.
20x25" Jones & Lamson, m.d., latest
4 spindle ⅞" Model R-4 Acme-Gridley, m.d.
4 spindle ⅜" Cleveland Model M, m.d.
4 spindle 2" Cleveland Model M, m.d., bar
4 spindle 2¼" Cleveland Model K, m.d.
2¼" Gridley Single Spindle, m.d.
2½" Cleveland Model A, m.d.
4¼" Cleveland Model A, m.d.
5½" Cleveland Model A, m.d.
6" Cleveland Model A, m.d.
7¾" Cleveland Model A, m.d.

HORIZONTAL BORING MILLS

Morris Mor-Speed, No. 5 Taper, m.d.
2½" Cleveland, m.d.
No. 25T Giddings & Lewis, m.d., 2½" bar, latest
No. 31 Lucas, 3" bar, m.d.
No. 33 Lucas, m.d., 4½" bar
No. 45 Giddings & Lewis, m.d., 5" bar
4" bar Detrick & Harvey Floor Type, m.d.
4" bar Landis Floor Type, m.d.
5½" bar Niles, m.d.
10" bar Sellers Floor Type, m.d.

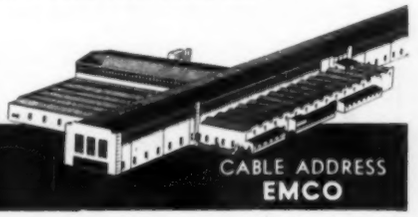
VERTICAL BORING MILLS

24" Bullard, m.d., with side head
36" Bullard Spiral Drive, m.d., with side head
36" Bullard New Era, m.d., with side head
42" Bullard New Era, m.d., with side head
42" Bullard Spiral Drive, m.d., with side head
42" Colburn H.D., m.d., 2 swivel heads
48" Cincinnati Rapid Production, m.d., 1 turret, 1 swivel head
48" Colburn H.D., m.d., 1 turret, 1 swivel head
48" Putnam H.D., m.d., 2 swivel heads
52" King, m.d., 2 swivel heads
54" Colburn, m.d., 1 turret, 1 swivel head
84' Niles H.D., m.d., 2 swivel heads, p.r.t.
100" Niles Heavy, m.d., 2 swivel heads, p.r.t.
100" Niles Extra Heavy Pattern, m.d., 2 swivel heads, p.r.t., late
120" Niles Heavy, m.d., 2 swivel heads

TURRET LATHES

No. 1 Cincinnati Acme Semi-Universal, m.d., chucking
No. 1 Cincinnati Acme Semi-Universal, m.d., bar
No. 1L, 2L, 3L Gisholt, m.d., Timken Bearings, hardened ways, standard length and extra long bed types
No. 1A, 2A, 3A Warner & Swasey Universal, m.d., plain bearing types bar and chucking machines
No. 2A, 3A Warner & Swasey Universal, m.d., Timken Bearings, covered ways, bar and chucking machines
No. 1A Warner & Swasey Universal, chucking, m.d., pre-selector head, latest
No. 3A Warner & Swasey Universal, chucking, m.d., latest
No. 2 Cincinnati Acme Full Universal, m.d., chucking, latest
No. 2 Pratt & Whitney Shaver, m.d.
No. 2B Foster Universal, m.d., chucking
No. 2G Morey Ram Type, m.d., bar
No. 3 Cincinnati Acme Full Universal, chucking, cross sliding turret
No. 3 Cincinnati Acme Full Universal, chucking
No. 3 Foster Geared Head, m.d., bar
No. 3B Foster Universal, m.d., bar
No. 3 Warner & Swasey Universal, m.d., bar, latest type
No. 3 Warner & Swasey as above, chucking
No. 4 Gisholt Universal, m.d., Timken, chucking
No. 4 Warner & Swasey Universal, m.d., chucking
No. 4 Warner & Swasey Universal, m.d., chucking, pre-selector head, latest
No. 4 Warner & Swasey as above, bar
No. 4 Warner & Swasey Plain, cone, motorized, bar and chucking types
No. 4A Warner & Swasey Universal, m.d., chucking, 8" hole, latest
No. 4A Warner & Swasey Universal, m.d., chucking, 7½" hole, Timken
No. 4R Cincinnati Acme, m.d. in base, bar
No. 5 Foster All Geared Head Universal, m.d., chucking
No. 5 Jones & Lamson Universal Ram Type, m.d., chucking, latest
No. 7 Baroons & Oliver Geared Head, m.d., bar
No. 7 Bardons & Oliver, motor in head type, chucking, late
2½" Jones & Lamson Universal Saddle Type, bar, late
2½x24", 3x36", 3½x32", 4x34" Jones & Lamson Geared Head, m.d., bar and chucking types
3¼" Cincinnati Acme Geared Head, m.d., chucking
18" and 26" Libby Turret Lathes, m.d.
16", 20" Acme Turret, cone
24" and 28" Gisholt, cone
No. 5 Woods Tilted Turret, cone

We carry an average stock of 2,000 machines in our 11 acre plant at Cincinnati. Visitors welcome at all times.



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MElrose 1241
CABLE ADDRESS
EMCO

LATE TYPE MACHINE TOOLS

MOST MACHINES

New — 1941-1945

Motor Driven — Excellent Condition

BORING MILLS

#22 Defiance, 2½" table type, 1945
#25B Defiance, 3¾", table type, 1943
#40—4" Landis Floor type
5" Ohio Floor type
6" Simmons Horizontal
#215A Excello Senior Double End
#48A Heald Single End Boremetic
#49 Heald Universal Single End Boremetic
#49 Heald Single End Boremaitc
#49 Heald Single End Boremetic Vertical

DRILLS

4' Morris 11" column Mor-Speed Radial Drill, 1943

GEAR MACHINERY

12" Gleason Straight Bevel Gear Generator
#13 Gleason Universal Gear Tester, 1941
15" Gleason Quenching Press, 1941
15" Gleason Spiral Bevel Cutter Sharpener, 1942

GRINDERS

#16 Bryant Internal, 1942
#72A3 Heald Plain Internal
#70A Heald Plain Internal
6"x18" Cincinnati Model EA Plain Hydraulic
10" x 18" Norton Type C Plain Hydraulic
14" x 48" Cincinnati Plain, 1942
#2 Cincinnati Centerless, 1940
16" x 16" x 48" Thompson Model C Hydraulic Surface, 1943
8"—#20 Heald Rotary Surface
12"—#A3 Arter Rotary Surface
#1 and #2 Brown & Sharpe Universal
#7 Grand Rapids Hydraulic Feed Universal and Tool
#13 Brown & Sharpe Universal and Tool
12" x 5" Jones & Lamson Model #TG125 Auto. Internal Thread, 1943
6" x 15" Jones & Lamson Model #TG615 Auto. Thread

HEADERS

#250C Manville SSSD Header
#2B Manville SSSD Header
5/16" National SSSD Ball Header
#33 Waterbury Farrel DSOD Header

LATHES

10" x 20" Monarch Model EE, 1942
16" x 30" Sidney Monotrol Geared Head
16" x 36" Pratt & Whitney Model B Geared Head
18" x 10' Hendey Geared Head
25" x 120" LeBlond Geared Head, 1943
27" x 48" LeBlond Geared Head
42" x 86" American Geared Head
42" x 108" Niles Geared Head, 1943

PRODUCTION MILLERS

#2-18 Cincinnati Plain Auto., 1940
#4-36 Cincinnati Plain Hydromatic, 1940
#1854 Kearney & Trecker Simplex

PLAIN MILLERS

#2SP and #3SP Van Norman Plain
#2M Cincinnati Plain
#3 Cincinnati Dial Type Medium Speed Plain
#5H Kearney & Trecker Plain
#5HM Kearney & Trecker Plain
#26 Van Norman Ram Type Plain, 1947

UNIVERSAL MILLERS

#3SU Van Norman Universal, 1943

VERTICAL MILLERS

#08 Cincinnati Vertical, 1940
#2 Standard Brown & Sharpe Vertical, 1942
#2 Cincinnati Dial Type Medium Speed Vertical, 1942
#3U Van Norman Vertical
#2K Kearney & Trecker, Vertical
#4H Kearney & Trecker Vertical
#4K Kearney & Trecker Vertical
#4 Reed-Prentice Vertical

MISCELLANEOUS MILLERS

4½" x 12" Pratt & Whitney Model C Thread
84" x 75" x 20' Ingersoll Adjustable Rail, 4 Heads

PLANERS

42" x 42" x 18' Gray, 3 heads
54" x 42" x 18' Gray, 4 heads
48" x 48" x 26' Niles Bement Pond, 4 heads

TURRET LATHES

#2 Warner & Swasey Electric Head
#3, #4, #5 Warner & Swasey Universal Geared Head
#1A Warner & Swasey Universal Geared Head
#5U Foster Universal Geared Head
#7A—2½" x 96" Jones & Lamson Univ. Geared Head
#1L Gisholt Universal Geared Head, 1942

WIRE — PHONE — WRITE

J. L. LUCAS & SON, INC.

BRIDGEPORT 5, CONN. **PHONE 9-3393**

AUTOMATICS

No. 0G Brown & Sharpe
8" Bullard Multaumatic
1⅞" Conomatic 8 spindle
14"x19" & 16"x33" Fay
Gisholt Simplimatic
1¼" Cleveland 4 spindle

BORING MACHINERY

3¾" bar No. 32 Lucas horizontal
4½" bar No. 33 Lucas horizontal
4" bar, No. 42 Lucas horizontal
3" bar Universal horizontal
100" Niles-Bement Pond, heavy pattern
53" Niles Bement Pond

DRILLS

21" & 24" Cincinnati upright
Nos. 121, 217, 314 & 315 Baker heavy
6', 15" Cint. Bickford radial
24", 6 spindle Foote Burt sensitive
4' Hammond Elbow Arm Radials
B4A—24 spindle Natco
24", 4 spindle Allen & Demco
12", 4 spindle Avey No. ½
15", 3 spindle Avey Type MA6

GEAR MACHINERY

No. 50 Cross Tooth Thinner
8H, 12H & 16HS Gould & Eberhardt
No. 12 Barber Colman
No. 5M Adams Hobber
No. 4 Cimatool Rounders
No. 130 Cleveland Rigidhobber

GRINDERS, CYLINDRICAL

4"x12" No. 4H Landis
6"x18" Norton, Landis, & Brown & Sharpe
Nos. 1, 2, & 13 Brown & Sharpe Universal
10"x18", 10"x30", & 10"x50" Norton mechanical
10"x18" Landis Type C, Hyd.
10"x24" & 16"x72" Landis Mechanical
14"x36" Landis Type C, Hyd.
16"x36" Landis Type D, Semi-Auto. Hyd.

GRINDERS, SURFACE

16" No. 10 Blanchard Rotary
30" No. 16 Blanchard Rotary
12" & 16" No. 22 Heald Rotary
16" & 24" No. 25A Heald Rotary
6" Pratt & Whitney Rotary
10"x24" Norton Hydraulic
12"x48" Thompson Hydraulic
14"x60" Mattison Hydraulic
14"x40" Pratt & Whitney Vertical
8"x22" Abrasive No. 3
8"x24" Abrasive No. 34 Vertical
24"x48" Springfield Planer Type
6"x18" #2 Brown & Sharpe

LATHES ENGINE

14"x6' Lodge & Shipley
14"x8' American
15"x6' Porter McLeod
16"x30" centers Monarch
36"x16' Bridgeford

LATHES TURRET

24" & 42" Bullard
Nos. 4, 1L & 3AL Gisholt
Nos. 3, 1A, & 3A Warner & Swasey
No. 3 Jones & Lamson
No. 2F Foster Fastermatic

MILLING MACHINES

Nos. 2H, 3H, & 4H Kearney & Trecker Vertical
Nos. 2, 3, & 4 Cincinnati Vertical
Nos. 1, 1M & 2 Kent Owens Hand
Nos. 1-12, 2-18, & 2-24 Cincinnati Automatic
Nos. 2-18 & 2-24 Cincinnati Rise & Fall Automatic
Nos. 3-24, 4-36, 5-48, 34-36, 56-72, & 56-90 Cincinnati Hydromatic
Nos. M-18, M-24, & 12-24 Kearney & Trecker

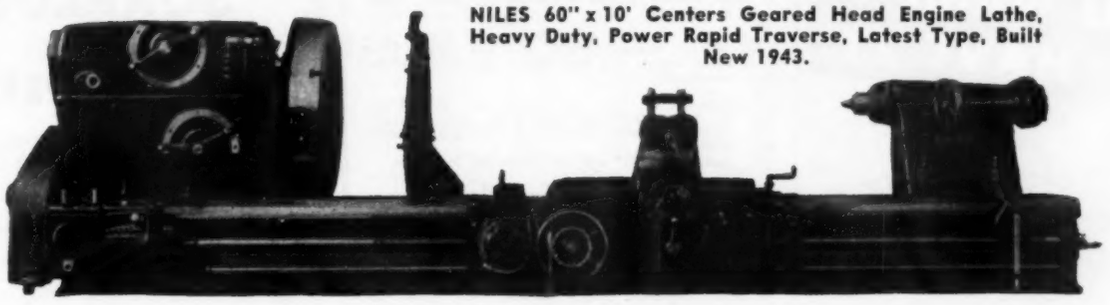
PRESSES

Nos. P1, P2, P3, P4 & P5 Ferracute punching
Nos. 10, 73½, 75½, 304 & 307 Bliss S.S.
No. 1½ Bliss cam drawing
200 ton & 1000 ton French Oil Hyd.
No. 2316½ Hamilton coiner
500 ton No. 2 National Maxi-press

MILES MACHINERY CO.

SAGINAW, MICH.

LATEST TYPE NEARLY NEW MACHINES



NILES 60" x 10' Centers Geared Head Engine Lathe, Heavy Duty, Power Rapid Traverse, Latest Type, Built New 1943.

BORING MILLS—Horizontal

CINCINNATI GILBERT 3½" bar, Floo, Type, Latest
DETRICK & HARVEY 4" bar, Floor Type, M.D.
GIDDINGS & LEWIS #25, 2½" bar, M.D.
HEALD #48A Single End, 2-spindle, Latest Type
HEALD #49 Universal, Single End, Latest Type
LANDIS #35, 3½" bar, Floor Type, M.D.
LUCAS #41—3" bar, Table Type, Latest Type
NILES BEMENT POND 5", 6" bar, Floor Type, M.D.
P & H #10 3½" bar, Floor Type, M.D.
UNIVERSAL 3" bar, high speed, Latest Type
UNIVERSAL No. 3A, 3" bar, M.D.

BORING MILLS—Vertical

BETTS 120", 2 swivel heads, AC, M.D.
BULLARD 16"—6 & 8 spindle, Mult-Au-Matic, Type D, Latest Type
BULLARD 36" Vert. Turret, side head, P.R.T., M.D.
KING 52", 62"—2 swivel heads, P.R.T., M.D.
NILES 38-44" Vertical Turret, side head, P.R.T., M.D.
NILES 84" 2 swivel heads, PRT, M.D.
NILES 100" 2 Swivel heads, Heavy, M.D.

DRILLS—Deep Hole

BARNES #420, 2 spindle, Hyd., Latest Type
BAUSH 1½x30" 2 spindle, Latest Type
LeBLOND #2 Single Spindle, Hyd., Latest Type
NILES 30"x50' Bed Boring, Timken, Latest Type
PRATT & WHITNEY ½Bx30", ½Bx50", 2 spindle, Latest Type

GEAR CUTTING EQUIPMENT

BARBER COLMAN Type A Hobber, Latest Type
BARBER COLMAN #12 hobber, M.D.
BROWN & SHARPE No. 3H gear cutter, M.D.
FELLOWS, #75, #725, #615A, #61, #7A, #72, #61A, #77 High Speed Gear Shapers; Latest Type
FELLOWS #12M Involute Measuring Instrument, latest
FELLOWS #6Z2 Gear Shaper; high speed; latest type
FELLOWS Model Z Gear Shaper; high speed
FELLOWS #13LS Lapper, latest type
GLEASON 3", 12" straight bevel generator, Latest Type
GLEASON #20 Spur Gear Tester, latest type
GLEASON #4, #6, #13, #18 Bevel and Hypoid Tester
GLEASON #17, Hypoid, Spiral, Bevel, Zerol, Latest
GOULD & EBERHARDT 36H Hobber, M.D.
GOULD & EBERHARDT 12HS hobber, Latest Type
PRATT & WHITNEY 10" Grinder, hyd., latest

GRINDERS—Cyl.—Plain & Univ.

BROWN & SHARPE #1, 2, 3 Universal, Latest
BROWN & SHARPE #5 Plain, 3 x 12, Latest Type
BROWN & SHARPE #20 10x18 plain, Latest Type
CINCINNATI 6"x18" Plain, Model EA, Hyd., Latest
LANDIS 10"x24" Type C, Universal, Hyd., Latest
LANDIS 4"x12", 4"x18", Plain, Type H, Hyd., Latest
NORTON 6"x18" Plain, Type C, Hyd., Latest
NORTON 10"x36" Plain, Type C, Hyd., Latest

GRINDERS—Miscellaneous

BRYANT #5, #16-16, #16-CP-16, #24 Internal Hydraulic, Latest Type
CINCINNATI #2 Plain Cutter and Tool, Latest Type
CINCINNATI #2, #3 Centerless "FILMATIC", Latest
CINCINNATI Centerless Lapper, Model E.D., Latest
COVEL #22 Universal Tool & Cutter, Latest
HEALD 70A, 75A, 72A3, 72A5, 74, 81 Internal Plain and Sizematic Hyd., Latest Type
JONES & LAMSON 6x15, 8x48, Auto. Thread, latest
LANDIS #6 Thread—6"x24", Latest Type

GRINDERS—Surface

ARTER 30" Rotary Model B Hyd., Latest
BLANCHARD #18, 36" chuck, Latest Type
BLANCHARD #11, 16" chuck, Latest Type
BLANCHARD #16, 24" chuck, M.D.
BLANCHARD No. 16A—Dial Type—M.D.
HEALD #25A Rotary, 16" and 30" chuck
HEALD #22 Rotary 12" chuck, Latest Type
MATTISON 14"x24"x72", Hyd., Latest Type
MATTISON 14"x16"x60" hydraulic, Latest Type
NORTON 6x18 Hydraulic; Latest Type
THOMPSON 16x30x48 hydraulic, Latest Type

JIG BORERS

VERNON Precision, M.D., Latest
PRATT & WHITNEY #1A, M.D.
PRATT & WHITNEY #3B Model 4854, Latest Type
REED PRENTICE #5, Latest Type

LATHES—Engine and Mfg.

AMERICAN 36"x360" centers, Geared, M.D.
AMERICAN 18"x72" centers, Geared, M.D.
BRIDGEFORD 36"x24' centers, 2 car., M.D.
HARDINGE TR-59, Latest Type
HENDEY 12x54" centers, Belted, M.D.
JONES & LAMSON "Fay" 20x25" automatic, Latest
LeBLOND 25"x96" Centers, Geared, M.D.
LEHMANN 16x30" centers, TIMKEN, Latest Type
LODGE & SHIPLEY 18x72 centers, M.D.
LoSWING 4x60, 4x84, 8x60, 8x198, 5x34, Latest
MONARCH 24"x54" Centers, M.D.
MONARCH 16x28" geared head, M.D.
MONARCH 10"x20" centers, Model EE, Timken, Latest
MONARCH 12"x30", 12"x54" centers, Timken, Latest
MONARCH 22"x456" centers, Model CM, 3 car., Timken Bearing, Latest Type
MOREY Model A 8"x120" shaft turner, Latest Type
NILES 90x110 centers Car Wheel, M.D.
NILES 42"x60" double head, M.D.
NILES 48x87' centers, 72x62' centers, comb. boring and turning, M.D.
NILES 60"x10' centers, Heavy Duty, PRT, Latest Type
PRATT & WHITNEY 16"x60" Centers, Geared, M.D.
PRATT & WHITNEY 10"x20" centers Bench, Latest
REED PRENTICE 16x24" centers, geared head, M.D.
SEBASTIAN 16"x36" centers, Type H, Timken, Latest
SPRINGFIELD 14"x6', 16"x6' bed, geared head, M.D.
WARD, HAGGAS & SMITH—18/30x66" centers gap

LATHES—Turret

BARDONS & OLIVER #5, #7, TIMKEN, Latest Type
CINCINNATI ACME No. 1 Timken, Latest
FOSTER #4FU "Fastermatic", Hyd., Latest
GISHOLT #1L, #2L Universal, Timken, Latest
GISHOLT #3, #4 univ., Timken, Latest Type
JONES & LAMSON #3, #5, #8A Univ., Timken latest
LIBBY No. 1H-5 Timken Bearing—latest—5½" hole
MOREY No. 2G, No. 3, No. 4 Timken Bearing, Latest
POTTER & JOHNSTON 5D, 5D2E, Timken, Latest
WARNER & SWASEY 5, Universal, Timken Bearing
WARNER & SWASEY #1A, Univ., Timken; Latest
WARNER & SWASEY 2A, Univ., Timken, Latest

MILLING MACHINES—Mfg.

INGERSOLL 42"x38"x12' adj. rail, 4 heads, A.C., M.D.
INGERSOLL 32x24x16' Planer Type, 2 heads, AC, M.D.
INGERSOLL 32x30x12' adj. rail slab, M.D.
SUNDSTRAND Model 3A Duplex, Latest Type
TAYLOR & FENN M80 Duplex Spline, Latest

MILLING MACHINES—Plain

BROWN & SHARPE #2 Light Type, Latest
BROWN & SHARPE #3B, TIMKEN, Latest
BROWN & SHARPE #12, 24" travel, Latest Type
CINCINNATI 0-8 Auto. Rise & Fall, Latest Type
CINCINNATI 1-12, 2-18 Timken Bearing, Latest
CINCINNATI 56-90 Simplex Timken, Latest
CINCINNATI #4 TIMKEN, Motor Drive
CINCINNATI 3, 4, 5, M.D.
CINCINNATI 4-36 hydromatic, Latest Type
KEARNEY & TRECKER 1218, TIMKEN, Latest
KEARNEY & TRECKER #3, 4, Heavy Timken, M.D.
KEARNEY & TRECKER #2H Timken, Latest
KEMPSMITH #4 Maximiller, Timken, Latest Type

MILLING MACHINES—Thread

HANSON WHITNEY 4"x9", Latest Type
LEES BRADNER Model HT, 12"x24", Latest Type
MOREY 12"x30", 60", 120", 190" centers, Latest Type

MILLING MACHINES—Universal

CINCINNATI #4 High Power, Motor Drive
KEARNEY & TRECKER #3B, M.D.
KEARNEY & TRECKER #2 Heavy, Timken, M.D.
KEMPSMITH #4 Maxi-Miller, Timken, Latest
VAN NORMAN #12, TIMKEN, Latest Type
VAN NORMAN No. 3 Duplex, Motor Drive

MILLING MACHINES—Vertical

CINCINNATI #2, #3, #4 Dial Type; Timken; Latest
CINCINNATI 0-8 Timken Bearing, Latest
GORTON 9J, without duplicator, Latest
KEARNEY & TRECKER 2H, Timken, Latest
MOREY 12M, 2 spindle, Profiler, Latest
REED PRENTICE 3VG with Hydraulic Duplicator Timken Bearing, Latest Type
SUNDSTRAND #3A, rotary, Latest Type

PLANERS

BETTS 96"x96"x20'—4 heads, PRT, Box Table, M.D.
CHANDLER 36x36x20', 4 heads, AC, M.D.
CINCINNATI 120"x96"x26'—4 heads, Box Table, M.D.
CLEVELAND 48"x60"x20' Openside; 3 heads; A.C. M.D.
DETRICK & HARVEY 48x48x16', 4 heads; Hyd.
GRAY 36"x36"x8'—2 heads, Max. service, D.C., M.D.
NILES BEMENT POND 48x48x16' 2 heads, AC, M.D.
NILES 54"x54"x18'—4 heads, Box Table, M.D.

PRESSES

BIRDSBORO 325 ton, vert. hyd., Latest Type
CHAMBERSBURG 50 ton, vert. hydro-pneumatic
CHAMBERSBURG 200 ton horiz. straightening, M.D.
CLEARING Type H-50-36 35 ton Vert. Hyd., Latest
CLEARING Type D8-1125-32 dbl. action 125 ton, Latest Type
FERRACUTE #DG-55, 75 ton drawing, Latest Type
GLEASON 15" Quenching, M.D.
HPM 37 Ton Hyd. Vert., Latest Type
LAKE ERIE 500 ton, Vertical, Hyd., Latest Type

MISCELLANEOUS

AJAX 1½", 2", 3½", Upsetter and Header, M.D.
BARNES #172, 306H, 307 Vertical Hone, Latest Type
BILLINGS & SPENCER 1500 lb. Board Drop Hammers
BROWN & SHARPE #4, 1½" cap. A.S.M., Latest
BROWN & SHARPE 2G Auto. Screw, High Speed, Latest
CAMPBELL #401 Abrasive Saw, Latest Type
CINCINNATI 1-30, 3-30 Duplex, Vertical, Surface, Double Ram Broach, Model ER, Hyd., Latest
CLEVELAND 12"x16' centers—Cutter Reliever, M.D.
FOSTER 4"x18" Super Finisher, Latest
GOSS & deLEEUW 8"—5 spdl., Auto. Chucker, Latest
LANDIS 1½" "Landmaco" Bolt Threader, Latest
MICHIGAN Model 1708, Hob & Cutter Reliever, Latest
NAZEL #4B Pneumatic Hammer, M.D.
PRATT & WHITNEY (KELLER) Type BL-2416 Copying, latest type, 2 & 3 Dimensional
PRATT & WHITNEY (KELLER) Type G Copying; latest type 2 Dimensional
QUICKWORK #6—1" cap., Rotary Shear, M.D.
ROCKFORD 20" Univ. Hyd. Shaper, Latest
RACINE #30C, 10"x10" Hack, Hyd., Latest
SMITH & MILLS 16" hi speed Shaper, Latest

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LATHES CUTTERS Presses SHEAR Planers Shapers GRINDERS MILLERS

LATHES

2—(BRAND NEW) Hendey 14"x30" and 18"x 48" GH Motor-in-Base Engine Lathes—12 spdl speeds—attachments

Pratt & Whitney 20"x48" Ctrs Model "B" 16-speed Engine Lathe—Motor-in-Base—Hole thru spdl 2"—Actual swing 21¼"—16 Spdl Spds 8 to 383 RPM—Taper attachment

Pratt & Whitney 16"x36" Model B Grd Head Motor-in-Base Engine Lathe, swing over ways 16½", dist. between Ctrs 36", hole thru spdl 1-11/16", 8 Spdl Spds 7—440 RPM

TURRET LATHES

5—Bardons & Oliver #3 Universal turret Lathes (very late type) swing 15⅝", hole in spindle 1⅞". 12 spindle speeds 67 to 1015 RPM, max. dist. turret face to spindle end 24", Bar Equipment.

VERTICAL MILLERS

Reed-Prentice #4 Improved Hydraulic Vertical Milling Machine (1942 vintage) complete with Detroit duplicating atchmt—Tbl Wkg Surf 70"x24", Range long 48", cross slide travel 24", vertical travel head 12"—top of Tbl to Spdl Nose max. 24", min. 12"—power rapid traverse —#50 Taper—18 Spdl Spds 30 to 1200 RPM—weight 18,000 lbs.

Brown & Sharpe #2 Light Type Vertical Miller (late type)—Tbl Wkg Surface 45"x10", range long 28", cross 10", vert 14", Spdl Spds 16, range 55 to 1800 RPM—power rapid traverse

PRODUCTION MILLERS

2— B & S #12 Pl. Mill. Mchs. motor driven, Tbl Wkg Surf 48⅝"x12"—feeds long 18", cross adj of spin 3¼", vert adj. of spin hed. 10½"—#50 Taper —electrically controlled, very latest type.

Cin. #4-36 Plain Hydraulic Miller—Motor in base —(late type)—Tbl Wkg Surf 53⅛"x16"—long feed 36"—automatic intermittent feed—power quick traverse.

Cin. #5-60 Duplex Tracer-controlled Hyd. Miller. Tbl Wkg Surf 20"x78½", cross range left hand quill 8", right hand quill 8", vert movement of spindle, tracer or manual control 13¼", very latest type.

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UNUSUAL VALUES

Milling Machines—No. 1, Universal. No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 3—20" Gould & Eberhardt 42".

Grinders—Cylinder B & S No. 11, Planer type 16"x36", Surface 13"x63", also new (small) Universal bench and floor type. All with coolant, meterized.

Lathes—14"x6', 8', 10'—16"x6', 8', 10'—18"x6', 8', 10'—26"x16'—all same drive, several motorized also (new) 18"x8' and 10' geared head, motorized.
Large stock 19" and 18" bench and floor type.

Planers—Single head 24"x6', 24"x8', 26"x8'.

Shapers—16", 20", 24", B.G. crank.

Turret Lathes—J & L 2"x24"—3'x36" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 36", 40".

SPECIAL—New totally enclosed dust proof, fan cooled, ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 3¼" from center of shaft to flatted top (1 h.p. to 15 h.p.) 1 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 25 24" Hi Duty 3" capacity in steel, motor attached.

PATTERN MAKING MACHINERY—42"x16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

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HIGH SPEED TOOL BITS

3/16"	square x 2"	long	$.05 each
¼"	square x 2½"	long	.10 each
5/16"	square x 2½"	long	.15 each
⅜"	square x 3"	long	.20 each
7/16"	square x 3½"	long	.35 each
½"	square x 4"	long	.50 each
⅝"	square x 4½"	long	.75 each
¾"	square x 5"	long	1.00 each
⅞"	square x 6"	long	1.25 each
1"	square x 7"	long	1.50 each

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G & E 24" Cin. 32" Shapers
Cleveland O.S. Planer 36"x8', 2 hds.
Abrasive No. 34 M.D. Vert. Surf Grinder
Cincinnati D. H. Planer 36"x36"x10', 2 hds.
Monarch 20" grd. hd., M.D. Lathe 16 sp, Speeds Model "M"
Bullard Vert. Turret Lathes, 24" & 36" S. Head
Defiance 3" Horiz. Boring Mill & Univ. No. 3-A
L & S 18x12' & 20'x10', 20"x8' Grd. Hd., M.D. & 28"x12' Lathes Monarch Model "C"
American 24'x12 grd. hd. lathe, m.d. q.c.g.
American 4-ton vert. Hydr. Broach
Blanchard Vert. Surf. Grinder, 26 rd. chuck
Cincinnati No. 2 Centerless Grinder
Colburn 60" & 72" Vert. Boring Mills
Cincinnati 1-M grd. hd., Univ. tool room Miller.
Cincinnati No. 5 H.P. grd. hd, S.P.D. Pl, Miller.
W. & S. No. 2A grd. hd, Univ. Turret Lathe, S.P.D.
Foster No. 2F Ostermatic grd. hd. Turret Lathe, M.D.

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ALL LATE TYPE TOOLS

18" x 12' SPRINGFIELD Lathe
No. 3 BARDONS & OLIVER Turret Lathe
No. 3 WARNER & SWASEY Turret Lathe
No. 2 CINCINNATI Vert. Mill, dial type
No. 4 CINCINNATI Plain Mill, Dial Type
No. 1224 KEARNEY & TRECKER Simplex
36" OHIO Extra Heavy Duty Shaper
6" x 18" CINCINNATI Cyl. Grinder
No. 615A FELLOWS Gear Shaper
12" GLEASON Bevel Gear Generator

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BEdford 8500

Roller Type Scalping Machine 22" Slab Capacity
#1A W&S Turret Lathes Bar Feeds
Libby 26" Turret Lathe, 4½" Hollow Spindle
#33 ExCello Ext. Thread Grinders
Norton Ext. Plain Grinder 24"x36"
Landis #3 Universal Cyl Grinder 16"x48"
Lees Bradner CT 36" Thread Millers
B&S #4, 36" Gear Cutters
Fellows 615 Gear Shaper
Farnham Forming Roll 12'
Onsrud Router Model A-4-RR 84"
#2B—4 sp. Edlund Drill 16"x52" Table
#2 Cincinnati Milling Machine, Plain
#3 LeBlond Plain Milling Machine

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Fisher 5" Bar, Floor Type Boring Mill. New in 1942.
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Size	Stroke	Delivery
6 Ton	1¼" or 1½"	10 days
12 Ton	1½" or 2"	Immediate
18 Ton	2" x or 2½"	Immediate
20 Ton	2½" or 3"	Immediate
24 Ton	2" or 2½"	Immediate
28 Ton	2½" or 3"	Immediate
38 Ton	3", 3½", or 4"	Immediate
55 Ton	3" or 3½"	Immediate
65 Ton	4" or 4½"	Immediate

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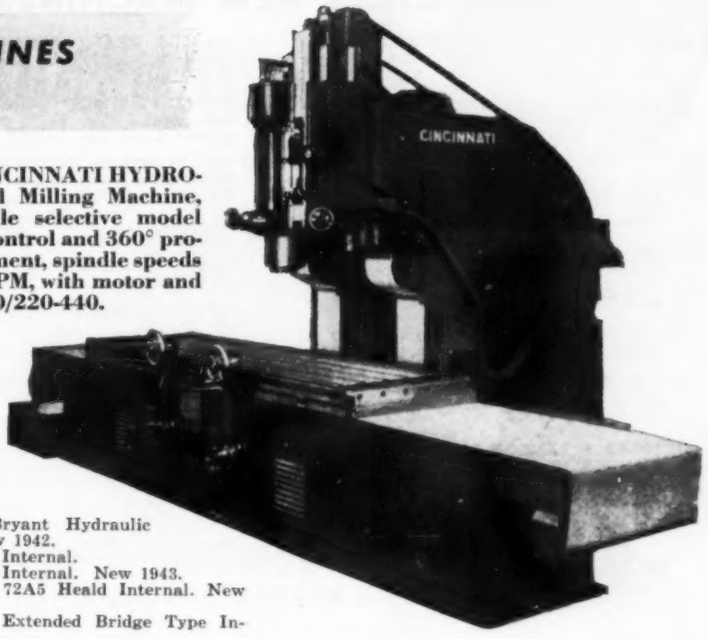

28″ x 60″ CINCINNATI HYDROTEL Vertical Milling Machine, single spindle selective model with depth control and 360° profiling attachment, spindle speeds 30 to 750 RPM, with motor and controls 3/60/220-440.

AUTOMATICS

9/16″ and 1″ RA-6 Acme-Gridley. New 1943.
1⅝″ 6 Spindle Greenlee. New 1942.
6″ 4 Spindle Conomatic. New 1942.
6″ Goss and DeLeeuw Chucking Machine—eight spindle. New 1943.
★**Bullard Multaumatic, six spindle model D, single index. Late Model.**

BORING MILLS

★**Universal No. 40 Tri-Way, 4″ bar, with facing head rotary table, boring bar, motor and control.**
Heald No. 49 "Bore-Matic," three spindles each end. New 1942.
Heald No. 47A "Bore-Matic."
Heald No. 46B "Bore-Matic."
Excello Model 2112A, single end. New 1943.

BROACHES

No. CPC 6-30 LaPointe Hydraulic Vertical. New 1941.
LaPointe Universal Broach Grinder.

DRILLS

6′ Carlton Radial, 17″ column.
3′ Cincinnati Bickford Radial, 9″ column. New 1943.
3′ and 4′ Dreses Radial, 11″ column enclosed head, motor on arm, 1938 model.
2′ Pfeffner Jack Knife Radial.
24″ Sibley Sliding Head.
25″ Fosdick Economax. Late model.
No. H3 Barnes Hydram, 8 speed. New 1942.
36 HO Baker. New 1942.
KH 2 Allen, 6 spindle. New 1943.
★**No. 2 MS Allen, one to three spindle, four speed motor on each spindle, 15″ overhang, extra large tables.**
Demco 3 spindle.
Hamilton-Muehlmat.
No. 3 Bausch Multiple Spindle.
Barnes Horizontal Deep Hole, two spindle.

GEAR CUTTERS

No. 7A & 715 Fellows Gear Shaper.
No. 615A Fellows Gear Shaper.
Red Ring Gear Shaper, Model G.C.L.
No. 12 Barber Colman Hobber
Model S Barber Colman Hobber.
Barber Colman Hob and Cutter Grinder.

GRINDERS

No. TG 615 Jones & Lamson Thread. New 1943.
No. 2 Cincinnati Centerless, Filmatic. New 1942.
★**No. 2 Cincinnati Universal Tool & Cutter complete. New 1942.**
No. 4T Sellers Tool.
No. 22 Covel Universal Tool & Cutter. New 1943.
No. 13 Brown & Sharpe Universal and Tool.
No. 3 Brown & Sharpe Universal. New 1943.
10″ x 24″ Landis Universal. New 1942.
14″ x 36″ Norton Universal.
4″ x 18″ Landis, Type H.
6″ x 18″ Cincinnati, Filmatic Bearing.
6″ x 18″ Norton Type C. New 1942.
10″ x 48″ Norton Type "C."
No. 22 Heald Rotary Surface. New 1943.
No. 18 Blanchard, 30″ chuck. New 1942.
16″ x 16″ x 48″ Thompson Model C. Surface.
3B Abrasive, with chuck. New 1943.
No. 5 Brown & Sharpe Surface. New 1942.
No. 15 & No. 18 Gallmeyer Livingstone Surface.
6″ x 12″ x 18″ Thompson Surface. New 1942.
No. 2B Reid Surface, for wet grinding.
No. 16CP16 Bryant Hydraulic Internal. New 1942.
No. 104 Rivett Internal.
No. 75A Heald Internal. New 1943.
No. 72A3 and 72A5 Heald Internal. New 1943.
No. 74 Heald Extended Bridge Type Internal.

LATHES, ENGINE

Hendey 12″ x 30″, g.h.
Reed Prentice, 14′ x 30″, g.h.
Lodge & Shipley Tool Room, 14″ x 54″, rel. att. New 1943.
Reed Prentice, 14″ x 78″, Toolroom. New 1943.
American Pacemaker, 16″ x 30″. New 1942.
Reed Prentice, 16″ x 54″. New 1943.
Sidney 18″ x 54″. New 1943.
Lodge & Shipley 20″ x 48″. New 1943.
28″ x 34′ "Timesaver," g.h. New 1942.
Lodge & Shipley 48″ x 54″, C.D.
Carroll Jamieson, 18″ x 5′, C.D.
South Bend, 14½″ x 6′ New 1944.
Lo-Swing, models IMP and R.
8″ x 15″ and 8″ x 21″ Sundstrand Automatic. New 1943.
8″ x 21″ Faye Automatic. New 1943.
14″ x 42″ Monarch "Magnomatic." New 1942.

LATHES, TURRET

Warner & Swasey No. 4A, with chuck, 7½″ hole.
★**Warner & Swasey No. 2A. New 1943.**
Jones & Lamson No. 9A. New 1943.
Gisholt No. 3L. Late Model.
Acme No. 1 Universal, saddle type. New 1941.
Bardons & Oliver No. 7 Ram Type, Bar Feed and Tooling. New 1942.
Gisholt No. 4 Universal, Hydraulic speed selector.
Warner & Swasey No. 5 Universal. New 1941.
Warner & Swasey No. 4 Universal. New 1941.
Warner & Swasey No. 3 Universal. New 1942.
Bardons & Oliver No. 3 Universal, motor in base. New 1941.
Warner & Swasey No. 2. New 1942.
Bardons & Oliver No. 2, bar feed. New 1941.

MILLS

Milwaukee No. 2D Vertical, Rotary Head. New 1945.
Milwaukee No. 2H Universal. New 1942.
Cincinnati No. 2M Universal.
Brown & Sharpe No. 2A Universal. Late type.
Kempsmith Maximiller Plain, No. 3.
Brown & Sharpe No. 3B Plain. New 1943.
Brown & Sharpe No. 2B Plain.
Cincinnati No 2M Plain.
Milwaukee No. 3H Vertical, latest model.
Cincinnati No. 2 Vertical. New 1940.
Index No. 40H Vertical.
Cincinnati Plain No. 08 and 2-18, Rise and Fall.
Cincinnati No. 1-12 and 1-18 Automatic.
Cincinnati No. 3-36 Hydromatic.
Cincinnati No. 34-36 Hydromatic High column with Hydrotel.
Milwaukee No. 1248 Simplex.
DeVlieg Supermill, No. 31B.
Brown & Sharpe No. 12. New 1942.
Kent Owens No. 1-14.
Whitney Hand Mill, No. 6.
VanNorman Hand Miller. New 1942.

MISCELLANEOUS

Grey Nibbler, 36″ throat, ¼″ capacity.
Savage Nibbler, 8″ throat, 3/16″ capacity.
Cleveland Rigidturner, No. 616.
14″ x 20″ Racine Hydraulic Saw.
13″ x 13″ Peerless High Speed Saw.
No. 26F Norton Hydrolap.
No. 8-6 Zeh & Hanneman S.S. Geared Press.
Toledo No. 41 Horn Press.
Williams White No. 14½ Punch, 1″ through 1″.
Tapper, Leland Gifford 3′ Radial, No. 3 M.T. New 1941.
Parker Tube Bender, No. 824G.
Schauer & Colbourne Speed Lathe.
5 H.P. L'Hommedieu Buffer.
5 H.P. Clark Buffer.
18″ Gardner Disc Grinder.
Lanfelier Type D Swager.

PLANERS & SHAPERS

Ohio Planer, 36″ x 36″ x 16′ M.D.
Cincinnati Planer, 42″ x 42″ x 20′, Four heads D.C.
Cincinnati Planer, 52″ x 36″ x 40′, Four heads. Box table D.C. motor drive.
Gould & Eberhardt 16″ Shaper.
American 24″ Shaper.
Smith & Mills 28″ Shaper.
Pratt & Whitney 6″ Vertical Shaper. New 1943.

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(1) JONES & LAMSON MODEL NO. TG615 AUTOMATIC THREAD GRINDER. Serial No. 130156. Excellent Condition. PRICE $2,750.00

(1) NO. 75-A HEALD INTERNAL GRINDER. Serial No. 22065. Excellent Condition. PRICE $2,250.00

(2) NO. 72A-5 HEALD INTERNAL GRINDERS. Serial Nos. 13939 and 13940. Excellent Condition. PRICE..$1,500.00 ea.

(2) NO. 74 HEALD INTERNAL GRINDERS. Serial Nos. 24602 and 24603. Excellent Condition. PRICE.....$2,250.00 ea.

(1) LANDIS 18 x 18 EXTERNAL GRINDER. Excellent Condition. PRICE $2,500.00

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375 ton Elmes, 12" stroke, 84x54 bed, late type
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250 & 750 Baldwin, 144x48 bed, 40" stroke
#408A Bliss Dbl. Action Toggle, 72x54 Bed, w/cushions, mtrs., controls.
#385 Bliss, 8" stroke, late, w/air cushions.
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200 ton 12" stroke, 27x27 bed, Bliss 43'.
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35 ton, 4, 5, 6" stroke, latest type, pract. new, w/all accessories, Bliss $850.00 ea.
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Inclinable, new, 20 to 70 ton, immed. dely.

AUTOMATICS, LATEST TYPE

#0G B & S, late type
1" New Brit. Grd., 6 spdl.
1⅜" R4—New Brit. Grid.
1½" & 1⅝" Cone—8 spdl. late
9/16", 1", 1¼", 1⅜", 2", RA6 Acme Grid.
2¼" & 2⅜" Cone 6 Spdl.
16" 8 spdl. Bullard Multaumatics, pract. new, (3) with some tooling, dbl. & sgl. index.
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6" bar Ingersoll Floor Type Mill 6' vert. & 6' hor., new 1943
5" bar Sellers Table Type Mill, 48" spin. to table, 100" spin. to outer support, '42.
4" bar Universal Table Type Mill, 60" spin. to table, 96" spin. to outer support, '42
3½" & 4" Landis Floor Type Mills
10"x48" Cinci. Grinder Plain, Late
48" x 19'6" centers Niles Heavy Lathe, Taper, new 1943
42"x84" centers Amer. Lathe, M.D.
36"x32' bed Niles Lathe, 2 carr., T.A.
20"x92" centers Hendey Lathe, T.A., collets
16"/19½"x54" cc Springfield Lathe, 1944
7' Carlton 17" col. Radial, 1943
Nos. 5, 4, 3 & 2 W. & S. Turrets, Late
#4 Gisholt Univ. Turret Lathe, 1942
No. 3K K. & T. Vert. Miller, 1942
48"x48"x24' Gray Planer, 4 Hds., Non-Metallic ways, '42. Var. Voltage
36"x36"x12' Cinci. Hypro Planer, 4 Hds., Var. Voltage, 1943
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48" N.B.P. Slotter, Grd., Late
15'x¾" Wicks, Bending Rolls, M.D.

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Lathe, Turret 3-A W and S. S.P.D.
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Universal 3" boring mill
Gorton Duplicators and Vert. Millers, 8D, 9J
Gorton No. 3U, 5L, 3Z, Engravers
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Landis #6 Thread Grinder
Hanson-Whitney Thread Miller
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Abrasive 6 x 18, 8 x 24 Surface Grinders No. 3B, 34, 1½
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Mod. 26 Rafter, New 1945
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Gisholt No. 4, 5, Univ. Turrets
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Oster 601 Rapiduction, Tooling
Hardinge ESM, 2nd operation
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Cinn. #2 Centerless Grinders Filmatic, Feeds
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Hammond & Excello Carbide Grind
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Sebastian 12x4' grd. hd.
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Peerless No. 226, Eyeletting
Hi Speed Hammers, all sizes
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Waterbury-Farrell #30 Thread Roller & Dies, 1943
Cinn. Bickford 24" Super Serv.
V & O 102 Reducing Press
V & O, Z & H 25, 35, 75 Ton OBI
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Stokes Tablet Presses
Ball & Jewel Plastic Grinders
20"x30" Boye & Emmes Grd. Hd., Lathe
Onsrud Router W240
Micromatic Hydrohoner H1
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LeBlond 19"x12 cs. Lathe, Removable Gap
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Black Diamond Drill Grinder
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Cleveland #1 Vertical Miller
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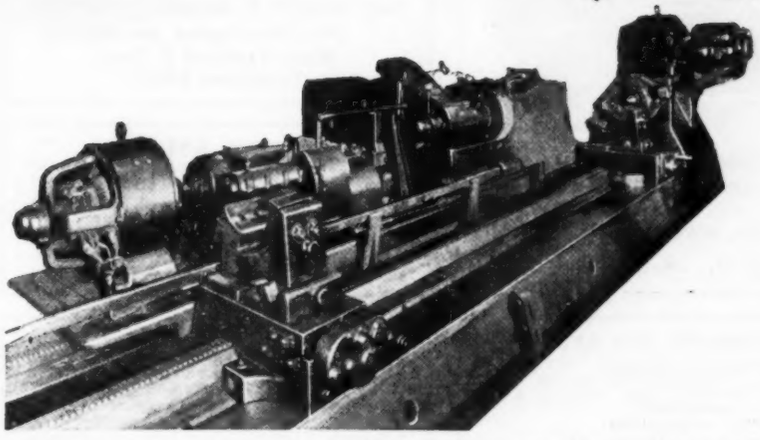

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J. & L. 2"x24", 3"x36"
W&S #4, 2A

GRINDERS

Surface Grinders, 6x18, 8x24, Abrasive, G. & L.
P. & W. 14", B.B., Vert. Surface 19"x49"
Blanchard 30", M.D.; Modern 12x48" M.D.
Norton Hydraulic 12x18", M.D. Cyl.
Heald No. 72A3 Gagematic
Norton 50"x28" M.D. Roll Grinder
Landis Type A 6x20" Hydraulic, M.D. Cyl.
No. 55, 60, 65 Heald Int., M.D.
12" Heald Rotary, Arter 12" M.D.
B. & S. No. 10, 11, Cyl.: 1, 3 Univ.

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26x12' Boye & Emmes 3 step cone D.B.G.
14"x6' Hendey Taper, Collets 16"x8'
9" LeBlond, P&W 1"x18" Automatic
36x30' Putnam M.D., 36x22', 42x16
32"x35' Wickes, M.D.
Wade, Hjorth, Hardinge, P & W Precision Bench

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Cleveland Model A ⅞", 1¼", 2"; B 1", 2", ⅞"
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Buffalo 25UD Comb. Punch-Shear
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Platen 35"x36", 36" stroke, 68" opening, 150 H.P., 220-440 V. Moter.

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Cleveland Vert. No. 1 M.D.; #1 Univ.
#2B K. & T. Univ.; No. 2, 2A B & S Univ.
No. 3B Cincinnati, S.P.D. rapid trav.
Nos 1½, 2, 5 B & S Plain & Univ.
Hall Planetary Model D Thread Miller
Becker Nos. 3, AB, 5, 6 Vert.
Nos. 2, 3, 4 Cincinnati Vert., S.P.D.
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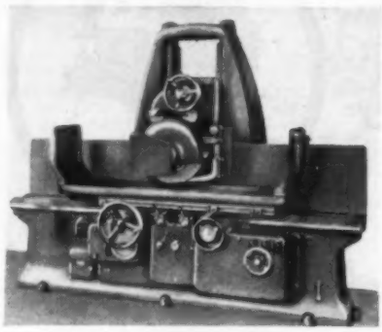

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Colburn Vertical Boring Mill, 38" Table, Straight and swivel heads. Mechanically tip-top.
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New Bratain Gridley, Model 60, Six spindle automatic.
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BRAKE: 8'x10 ga. D & K Power Box & Pan
CRANES: 15 Ton-27' span Gantry; 10 Ton-38' span OET; 7½ Ton-38' span OET.
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MILL: 3K Kearney & Trecker Vertical, Late Type
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Ex-Cell-O #1212A double end precision boring machine with two DB-22 and two DB-24 Spindles. Equipped with Hydraulic cross slide and hydraulic operated draw bar releases. Six months previous use. Machine ready for operation. $4,000.00.

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BORING MILL, Hor. #0 G & L, 3" bar
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GRINDERS, Surf. Nos. 3 & 5 Abrasive
GRINDER, Surf. Rotary No. 25 Heald
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MILLER, Thread, No. 40 Lees-Bradner
MILLER, Duplex, 24" Cincinnati
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PLANER, 72"x72"x20' N-B-P, 2 hds., m.d.
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PRESS, Wheel, Hyd. 400 ton Niles 88"x18'
SHAPERS, 24" and 32", M.D.
SHAPER PLANERS, Openside, 26" Farquhar
SHEARS, 8' x 10 ga., 12' x 18 ga., 11' x 1½"
SHEAR, Alligator, No. 1½ D & K, 2" rd.
SHEAR, Sq., No. 372 Stoll
STRAIGHTENER, No. 0 H & J, 96" x 5½"

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1⅝" Greenlee, 6 Spdls (1941)
No. 61 New Britain 6 spindle 2¼"
No. 6 Brown & Sharpes

DRILLS

No. D-8 Colburn No. 6 Morse Taper
No. 1LMS 20"—6 Spdl. L.G.
No. 2LMS—26"—4 Spdl. L.G. (1942)
No. 2LMS—26"—2 Spdl. L.G. (1945)
No. 2LMS—14"—4 Spdl. L.G.
No. 2MA6—15"—4 Spdl. Avey
No. 3B—24"—6 Spdl. Edlund (1942)
No. 2—8 Spdl. Leland-Gifford
No. 4 BL Natco 36 Spdls.
7'-15" Col. American Full Universal

GEAR MACHINES

No. 712 Fellows Auto Indexing (1943)
No. 72 Fellows Gear Shaper
No. 18-H Gould & Eberhardt
11" Gleason Bevel Gear Cutter
72" Cincinnati Gear Cutter
No. 13 Gleason Univ. Tester

HOR. BOR. MILLS

No. 26 Defiance, 4½" bar (1943)
No. 31 Lucas, 3" bar
No. 3A Universal, 3" bar
Rockford, 3⅛" bar

GRINDERS

4"x12" Landis, Model H (1942)
4"x18" Landis Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"x18" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
Norton Motor Driven Plain Grinders
6"x18" —— to —— 24"x240"

12"x36" Landis Type LCH Universal (1945)

No. 5—8"x24" Covel Hydr. Surf. (1941)
24"x24"x84" Mattison Hydr. Surf.
No. 34 Abrasive Surface (1943)
No. 22—12" Heald Rotary Surface
No. 25A—24" Heald Rotary Surface (1943)

72A-3 Heald Internal Grinder
72A-5 Heald Internal Grinder
74 Heald Internal Gdr.
No. 5 Bryant Internal Grinder
No. 16-16 Bryant Internal Gdr.
No. 16-38 Bryant Internal Grinder
No. 24-26 Bryant Internal Grinder

10"x72" Colonial Broach Grinder

LATHES

14"x6' Hendey
15"x5' Sebastian
16"x54" centers LeBlond
18"x6' American
22"x48" centers Monarch
36"x30' Lodge & Shipley
36'—48"x16' Lehman Hydrotrol (1945)
48"x20' centers Simmons
50"x17' centers LeBlond (1942)

LATHES (Production)

8"x15" Sundstrand, Model D (1943)
10"x22" Sundstrand, Model AA (1943)
12"x18" Lipe Carbo
16"x33" Fay Automatic (1942)
20"x25" Fay Automatics (1942)

MILLING MACHINES

No. 4 Cincinnati Plain (1943)
No. 08 Cincinnati Vert. (1942)
No. 2H Milwaukee Vert. (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati Vert. High Power
No. 1 U.S. Hand Millers
24" Cincinnati Production
No. 1-18 Cinn. Mig. (1940)
No. 2—18" Sundstrand Electromil (1942)
No. M-18 Milwaukee Simplex (1942)
No. M-24 Milwaukee Simplex (1942)
38"x40"x10' Fitchburg Duplex Miller (1943)
No. 4-48 Cinn. Hyd. Tracer (1942)
No. 45-48 Cinn. Hyd. Plain Tracer (1942)
No. 56-90 Cinn. Hydromatic (1943)
No. 2 Hanson-Whitney Thread
4"x9" Hanson-Whitney Univ. Thrd. Miller
4½"x12" Pratt & Whitney, Model C
6"x20" Pratt & Whitney, Model C
6"x36" Lees-Bradner—Model HT (1943)
6"x48" Pratt & Whitney Thrd. Miller
6"x132" Pratt & Whitney Thread Miller
10"x48" Hanson-Whitney Thread Miller (1942)
4" Taylor & Fenn Spline, M.D.
24"x24"x12' Ingersoll Adj. Rail
36"x36"x16' Ingersoll Slab Miller
72"x6' Ingersoll Face Miller (1941)

MISCELLANEOUS

18" Dill Slotter
Model H-7 Micromatic Hydro Honer
Model H-705 Micromatic Hydro Honer
Model H-2 Micromatic Hydro Honer
Model 200 Micromatic Hydro Honer
No. 22-C Racine Shear Cut Hack Saw
8-M Wells Band Saw
No. 20 Bliss O.B.I. press
No. 2 V & O open back press
No. 0 Bakewell Tapper
Baush Tapper

PLANERS

36" x 36" x 12' Cincinnati
36" x 36" x 18' Gray
48" x 36" x 14' Gray
48" x 48" x 12' Cincinnati

TURRET LATHES

No. 2 B. & S. Screw Machine, Wire Feed
No. 3 Bardons & Oliver (1942)
No. 5 Warner & Swaseys (1942)
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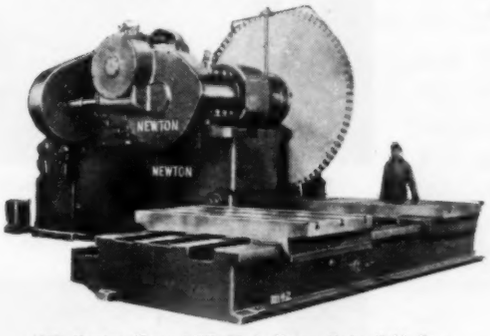

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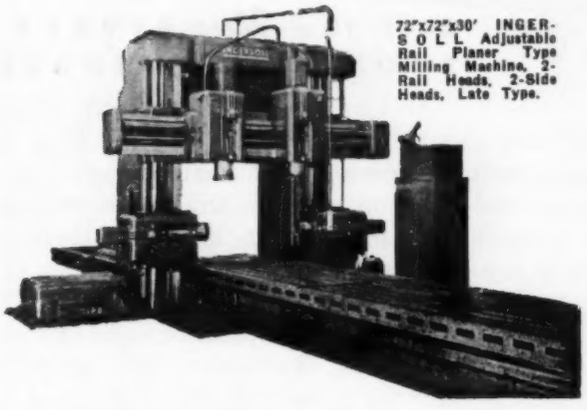

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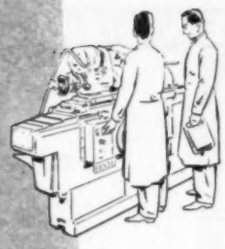

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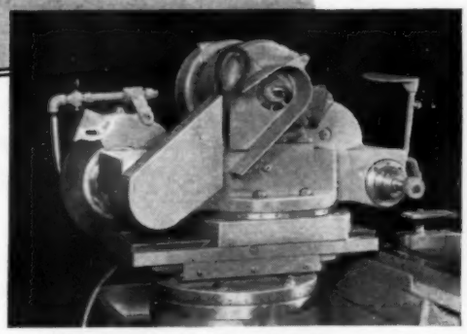

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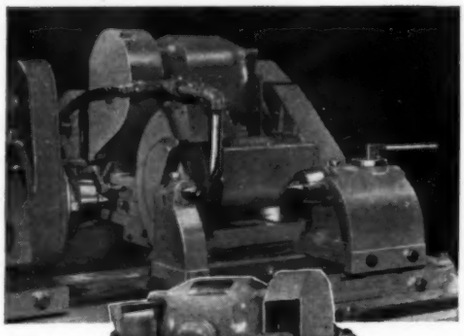

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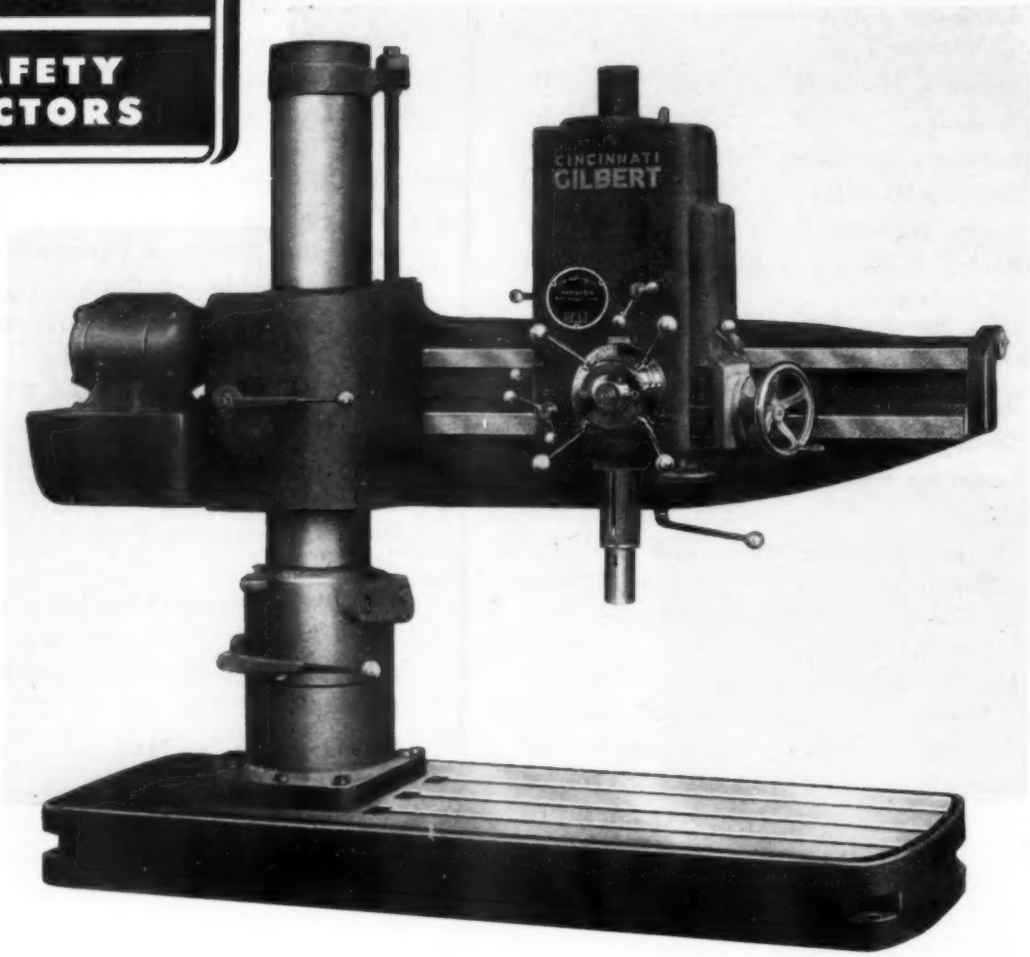

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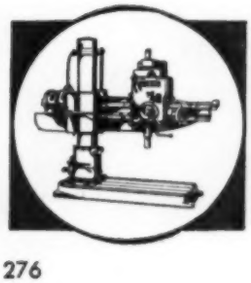

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WASTE TO SAVE?

YES, Waste Destructive Heat to Safeguard Machine Efficiency

You get more out of machines when you waste destructive heat. That's a job for HARRISON OIL COOLERS. They'll pay for themselves through increased production, long machine life. Consult Harrison engineers.

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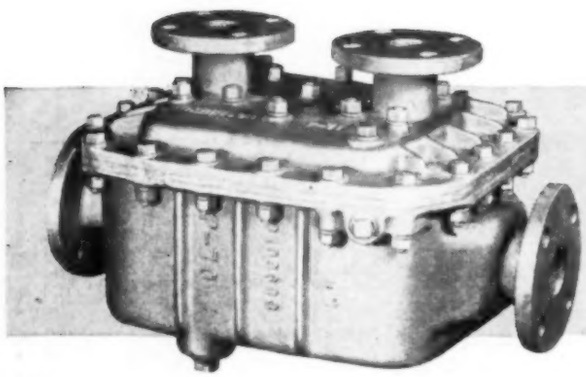
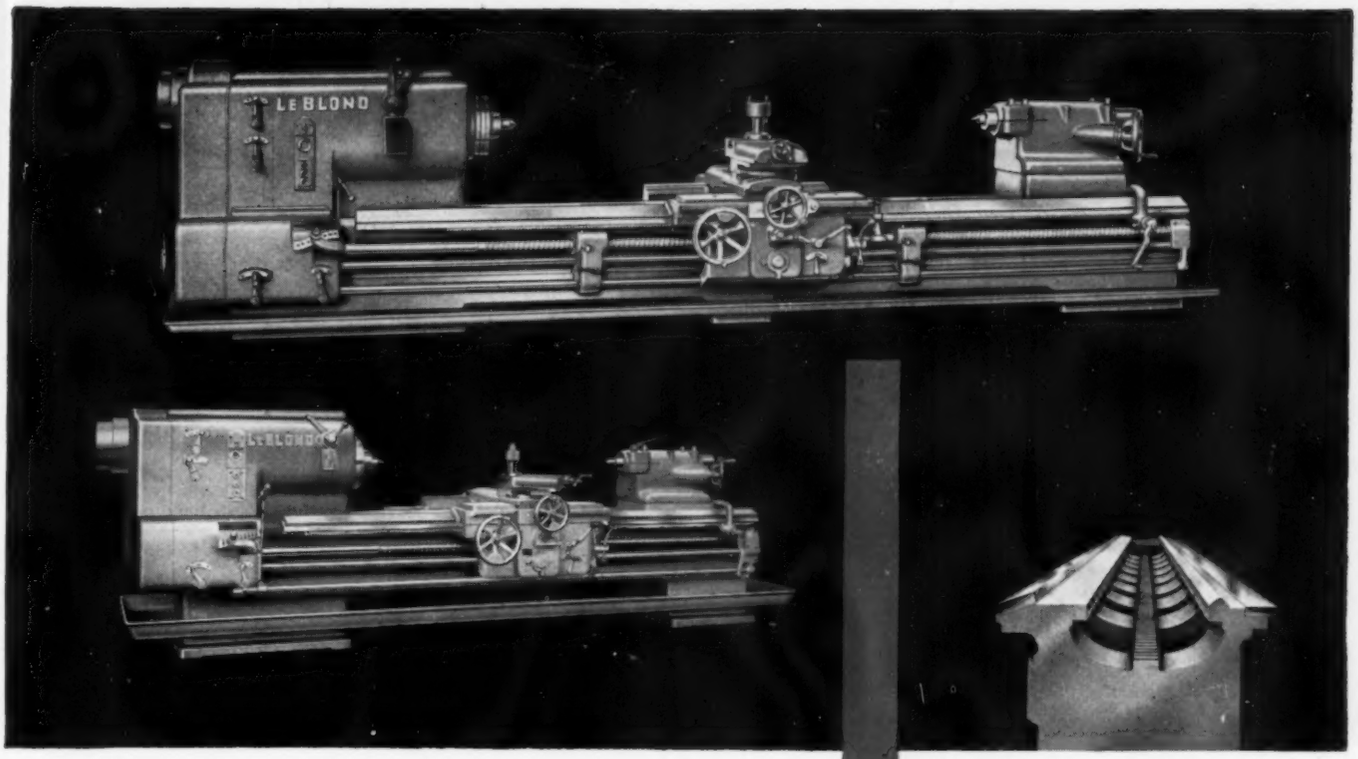


HARRISON OIL COOLERS
FOR INDUSTRIAL APPLICATIONS

HARRISON RADIATOR DIVISION OF GENERAL MOTORS CORPORATION, LOCKPORT, N. Y.



Hardened Ways and Enclosed Feed Box assure long life accuracy of the new 25" and 32" LeBlond Heavy Duty Engine Lathes...

The hardened and ground steel bed ways—furnished as standard on the new 25" and 32" LeBlond heavy duty engine lathes—give you the accuracy you need today and tomorrow. The ways are hard (62-66 Rockwell C), are replaceable, and retain lubricant thereby reducing friction and wear.

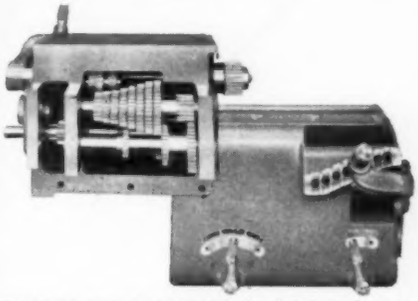
The totally enclosed, automatically lubricated quick change box eliminates all feed box maintenance, and assures longer gear life. Gears are inside a protective oil-tight casting which chips and other abrasive matter positively cannot penetrate. Clean, filtered oil supplied continuously, automatically.

And there are many more advantages including the exclusive LeBlond one-piece apron with single lever cross and length feed control and the thrust-lock tailstock with full length bearing support for spindle.

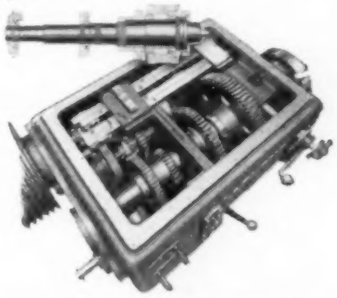
for complete information

ask the LeBlond distributor nearest you for the latest bulletins.

HARDENED AND GROUND STEEL BED WAYS are furnished at no additional cost. Note front way is fitted to conform to the LeBlond compensating vee-way principle.



ENCLOSED QUICK CHANGE BOX is lubricated automatically, requires no operator attention. Your choice of two optional ranges of feed and thread changes.



16 SPEED GEARED HEADSTOCK. Three-bearing spindle, free running gear train. High speed gears shaped or hobbed, hardened and ground. Your choice of two optional ranges.

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

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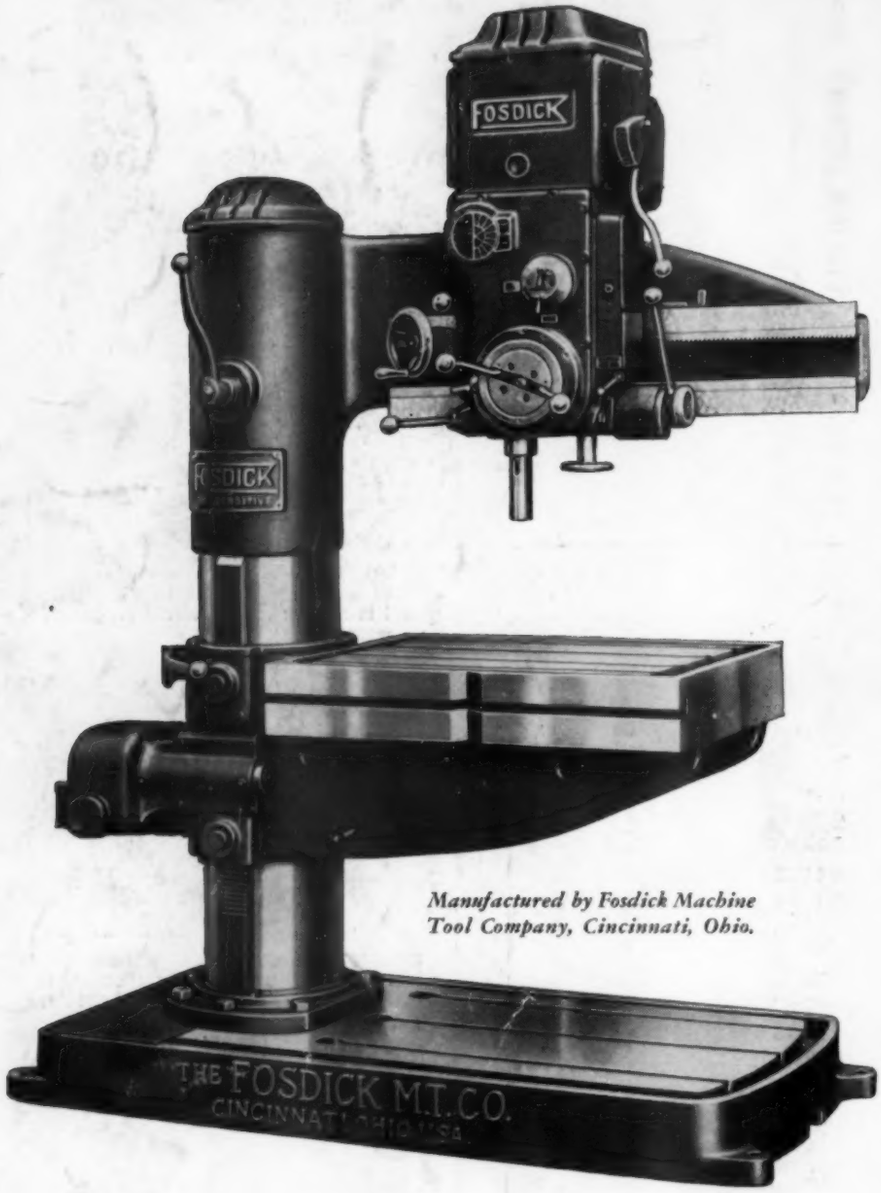
LEBLOND

Why the new Fosdick radial drill swings its arm on Timken® bearings



Manufactured by Fosdick Machine Tool Company, Cincinnati, Ohio.

THIS new Fosdick radial drill works differently than most. The table moves up and down instead of the drilling arm. And both the table and the drilling arm can be swung around the column 360°.

To keep the drilling arm in accurate alignment, despite severe overhung loads, it is mounted on two big Timken tapered roller bearings. Wear on the column is eliminated, precision drilling insured. And, because Timken bearings eliminate friction, a feather touch will swing the drilling arm easily to the desired position.

Timken bearings are made from the finest steel ever developed for tapered roller bearings—Timken fine alloy steel. They take both radial and thrust loads in any combination and are built to last the life of the machine.

Remember that Timken bearings in your product add a valuable sales feature. They build greater acceptance for your product among customers. So always look for the trade-mark "Timken" on the bearings you buy. And when buying new machinery, be sure that it's Timken-equipped as usual. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.

TIMKEN BEARING CAPACITY RATINGS INCREASED 25%.

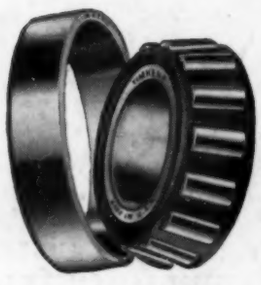
Since Timken bearings were re-rated some 15 years ago there has been such a further and constant improvement in quality that we are now able to announce a 25% increase in radial and thrust load carrying capacity. This may make possible the use of smaller bearings with savings in bearing cost, material cost and weight. Engineers will be able to utilize the advantages of Timken bearings in more applications than in the past.

A new Timken Engineering Journal, now in preparation, will give you complete capacity rating tabulations. For further assistance, write us today.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◎ AND THRUST →◎← LOADS OR ANY COMBINATION →◎←